CR-171829

FINAL REPORT

ON

PROTOTYPE WASH WATER RENOVATION SYSTEM INTEGRATION WITH
GOVERNMENT-FURNISHED WASH FIXTURE

Contract NAS 9-17004

DRL ITEM 3

Prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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Houston, Texas 77058

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By

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1.0 INTRODUCTION

The requirements of a significant quantity of proposed Life Sciences experiments in Shuttle payloads for available wash water to support cleansing operations, has provided the incentive to develop a technique for wash water renovation.

This effort is directed to provide a prototype wash water waste renovation system which has the capability to process the waste water and return it to a state adequate for reuse in a typical cleansing fixture designed to support Life Science experiments. The resulting technology will also support other development efforts pertaining to water reclamation by serving as a pretreatment step for subsequent reclamation procedures.

Previous efforts have resulted in the development of a breadboard system (NAS 9-15369), a preliminary prototype system (NAS 9-15931), and integration of the prototype system with a Government supplied cleansing fixture (NAS 9-15601).[a] This effort has addressed some problems encountered in the previous effort, provided for additional testing of this unit and provided for examination of the product water to identify the source of approximately 45 to 77 ppm organics that were not removed by the adsorbers. It also provided for evaluation of a GFE microbial check valve installed in the product water line.

a. The Appendix of this report contains some diagrams and photos of the PWWWRS previously presented in the Final Report (NAS 9-16501) for ready reference.

2.0 OBJECTIVES AND SCOPE

The objectives of the proposed program were aimed at optimizing the performance of the PWWWRS through:

- Identifying trace organic material(s) in the product water which is not being removed by the adsorbers, and reformulating the soap so as to avoid this component(s) which resists removal,
- Conducting extended testing of the prototype system, evaluating the reliability of system components, and correcting any mechanical or electrical problems which may arise, and
- Evaluating the ability of the GFE microbial check valve to eliminate or minimize the presence of microorganisms in the product water.

CONCLUSIONS

1. The impurities found in treated wash water were mainly EDTA salt with trace quantities of lactic acid and lanolin.
2. The SB-40 cleanser can be modified to eliminate the EDTA salt. Rochester Germicide Company Sales Executive has stated they are willing to modify the formulation deleting the EDTA ingredient for this application.
3. Extended testing has revealed certain components that were failure prone. Components such as a bladder, and valves have been replaced. Corrective design was incorporated to eliminate reoccurrence of the failures.
4. The GFE microbial check valve was installed in the product water line and proved to be effective in reducing microorganisms to less than 2 per milliter.

3.0 TASKS

The tasks reported are:

3.1 Analysis of Typical Product Water

3.2 Modification of Cleanser

3.3 Conduct Extended Testing

3.4 Evaluate the GFE Microbial Check Valve

TASK 3.1 ANALYSIS OF TYPICAL PRODUCT WATER

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3.1 ANALYSIS OF TYPICAL PRODUCT WATER

3.1.1 INTRODUCTION

The objective of this analytical study was to detect and identify residual organics in one typical product water sample. Previous analyses[1] indicated that trace quantities of some organic compound(s) were not being removed by the absorber and ion exchanger of the waste water renovation system.

This analytical task was completed with a thorough search for impurities and their identification in one typical water sample (treatment cycle #18[2]). A second sample (treatment cycle #19[3]) was only examined for total organic carbon and carbonyl content.

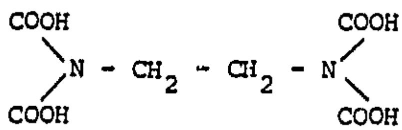
The analytical task was performed in two steps.

Step 1 - Development of analytical methods for organic candidates used in soap formulation. The potential residual impurities are:

- Fragrance - chemical composition not given. Our preliminary analytical GCMS analyses detected a series of cyclic and aromatic isomers.

- Ethylenediamine Tetraacetic Acid (EDTA)

  Chemical Formula:



  Molecular Weight: 292
  Solubility: Water (at 150°C, decarboxylation)

- Lanolin

  Chemical structure: Wax, mixture of esters and polyesters of 33 high molecular weight alcohols - contains also 25-30% H_2O.

  Solubility: Insoluble in water; soluble in $CHCl_3$, ether, benzene, acetone, and CS_2.

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1. See Paragraph 3.1 of the SOW, Exhibit A, Task 1: Conduct Analysis of Trace Residual Organics not Removed by the Adsorbers from Renovated Wash Water.

2. Water sample from treatment cycle #18 analyzed for organics and inorganics after absorber and ion exchange treatments.

3. Water sample analyzed for Total Organic Carbon (TOC) and carbonyl (soap) after each cleanup step.

- Dye - Chemical formula not available.
- Glycerol (Trihydroxypropane)

  Chemical Formula: $CH_2OHCHOHCH_2OH$

  Molecular Weight: 92.09

  Solubility: Water, and alcohols; insoluble in $CHCl_3$, benzene, and petroleum ether.
- Lactic Acid

  Chemical Formula: α-hydroxypropionic acid, $CH_3CH(OH)COOH$

  Molecular Weight: 90.08
- Urea (carbamide) $NH_2-CO-NH_2$

  Molecular Weight: 60

The analytical methods development in step 1 are presented in the "Appendix for Task 3" at the end of the report.

The analytical approach developed in step 1 was then applied and/or expanded for actual analysis of residues in a wash water sample (step 2) which is the subject of this report.

3.1.2 ANALYTICAL METHODS USED

A total of 8 instrumental analytical methods[1] were utilized for analyses of water residues:

1. Gas Chromatography - Mass Spectrometry (GCMS)
2. Purge and Trap GCMS (P+T - GCMS)
3. Direct Insertion Probe - Mass Spectrometry (DIP-MS)
4. Fourier Transform Infrared Spectroscopy (FTIR)
5. Ultraviolet - Visible Spectroscopy (UV/VIS)
6. Atomic Absorption Spectroscopy (AA)
7. Pyrolysis - GCMS (Pyr-GCMS)
8. Total Organic Carbon Analyzer (TOC)

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1. In addition to wet analytical methods (e.g. silylation, sample preparation, etc.)

3.1.3 RESULTS

All analytical methods indicated above were utilized for analysis of residual components, organic and inorganic, in the water samples.

Samples for Analysis

- One typical water sample (700 ml from treatment cycle #18, (stored in a glass jar covered with an aluminum lined lid) was received on 7/22/84 for all additional analyses, as described in the following section.

- One typical water sample from treatment cycle #19 was used for TOC and carbonyl group analyses after each purification step.

Analytical Flowchart for Residues in Water from Treatment Cycle #18

A search for individual impurities in one water sample was performed as shown in the following diagram on page 4.

Total Organic Carbon and Carbonyl Groups in Wash Water after Treatment Cycle #19

The total profile of water impurities, analyzed for carbonyl groups and TOC, after passing through adsorber and ion exchanger, are summarized in Table I.

TABLE I

A TYPICAL WATER SAMPLE ANALYZED FOR TOC AND CARBONYL GROUPS AFTER PASSING THROUGH TWO PURIFYING STAGES - ADSORBER AND ION EXCHANGER

	Water Sampled After Adsorber				After Ion Exchanger	
Wash Water Treatment Cycle	Soap, ppm(1)	Soap(2) TOC	Total(3) TOC	Non-Soap TOC	Soap, ppm	TOC
19(4)	5-8	4-6	23-24	17-20	0-1	11-12

(1) by CCl_4 extraction/IR for carbonyl (5.75μ)

(2) calculated from soap analysis (based on Palmitic acid)

(3) York Research Laboratories, Inc., Monroe, Connecticut

(4) sample #18 is expected to have a similar profile

WATER FROM CYCLE #18

(AFTER ABSORBER AND ION EXCHANGER)

1.	2.	3.	4.	5.	6.
Ash Analysis Metal Analysis	Purge and Trap GCMS	Derivatization-GCMS	Thermolysis DIP-MS	UV/VIS/FTIR	Pyrolysis GC/MS
(Atomic Absorption)	Analysis for Fragrance	Glycerol Lactic Acid EDTA	Analysis for long aliphatic fragments from soap (oleic acid, lanolin, etc.), urea and other higher molecular fragments	UV/VIS: Analysis for traces of dye FTIR: Analysis for organics	Analysis for higher Organic fragments

Analysis of Residues in Wash Water after Treatment Cycle #18

The analytical method deve'opment in Phase 1 of this study was focused on detection of potential impurities used in soap. When analyzing an actual water sample, some unanticipated impurities were encountered during the search for "potential residues" (see section 3.1.1 on pages 5 and 6.

The analytical results obtained from the water sample analyses are summarized in Table II.

TABLE II

SUMMARY OF RESULTS OBTAINED FROM ONE WATER SAMPLE (TREATMENT CYCLE #18), AFTER PASSING THROUGH TWO CLEANING STEPS - ABSORPTION AND ION EXCHANGER

Components Analyzed	Concentration Found	Method Used	Comments
Inorganics Total:	.24 ppm	Ash	
K	1 ppm	AA	(AA - atomic absorption)
Na	0.5 ppm	AA	
Ca	0.2 ppm	AA	
Si (a siloxane)	+	GCMS	(+=found but not quantified) (GCMS = gas chromatography - mass spectrometry)
Organics Total:	69 ppm[1]		Residue at 105°C (minus ash, presence of some H_2O in the residue cannot be excluded)
o Fragrance	not detected (i.e. <0.5 ppm)	P+T GCMS	See Fig. 1a - 1d
o Ethylenediamine Tetra-acetic Acid (EDTA) - acidic form	not found	GCMS FTIR	Derivatization
EDTA - salt	approx. > 50 ppm[2]	FTIR	See Fig. 2a - 2d

1. In Contract NAS 9-16501, the organics content ranged between 50 and 165 ppm before passing through absorbers.

2. Complexing metal(s) not known.

Table II - Continued

Components Analyzed	Concentration Found	Method Used	Comments
o Lanolin	+	DIP-MS	Presence of higher aliphatic alcohols (C_{29}, C_{32}) indicated by mass spectral search, see Fig. 3a - 3h.
o Dye	not found	UV-VIS	No UV/VIS maximum detected
o Glycerol	not found (i.e. <1 ppm)	GCMS	After silylation
o Lactic Acid	<20	DIP-MS	See Fig. 4
o Urea	not found (i.e. <10 ppm)	DIP-MS	See Fig. 5
Additional organics found:			
Two phthalates	+	DIP-MS	See Fig. 6a - 6e
Methylene Chloride	>1 ppm	P+T - GCMS	See Fig. 1a, probably not from washing cycle, but from atmosphere in lab and/or refrigerator
Dimethoxy Propanol	traces[1]	P+T - GCMS	
An Ether	traces[1]	P+T - GCMS	
Higher aliphatic mass fragments	+	DIP-MS	Mostly from lanolin wax, see Fig. 3, 6
Water Insoluble Residue	beige precipitate	FTIR	See Fig. 2d (probably from ion exchange resin)

1. <1 ppm

3.1.4. CONCLUSION

The main organic impurity in the treated wash water sample was identified as EDTA salt. Trace quantities of lactic acid and lanolin were also indicated.

3.2 MODIFICATION OF CLEANSER - ROCHESTER GERMICIDE

The analysis of residual organics in typical product water revealed that the main impurity in the treated wash water sample was identified as EDTA[a] salt. Trace quantities of lactic acid and lanolin were also found. The EDTA is used as a sequestering agent for calcium usually found in hard water. Removing this ingredient from the soap formula SB-40 by Rochester Germicide is no problem. Without the use of EDTA in the cleanser, the water would be cloudy if calcium were present. The ion exchange resin in the system is designed to remove metals from the stream, therefore, calcium is not expected to be present in the product water.

The system has allowed less than 20 ppm of lactic acid and less than 1 ppm of lanolin and phthalates to pass into the product water. The lactic acid, and ingredient in the spiked water, simulates a component of body fluids from the skin.

The Rochester Germicide Company is willing to provide a modified formulation of SB-40 cleanser deleting the EDTA and lanolin ingredients for this application.

(a) EDTA - Ethylene diamine tetraacetic acid

3.3 CONDUCT EXTENDED TESTING

Preparation

The system having been dormant for several months prior to this program, required preparation for the test series.

Routine Maintenance

Filter elements were discarded and the tanks in the system were back flushed with clean water. New filter elements, new ion exchange resin and new activated carbon were installed in the system.

Corrective Maintenance

The waste tank was removed to inspect the bladder. A pin hole was found in the top seam. A new bladder was installed. The steel tank walls showed signs of corrosion where epoxy coating had peeled. The walls were scoured by sand blasting and the tank walls were recoated with epoxy. The jet agitator was incrusted with flocked material. The surface was cleaned, however, no impairment of function was indicated as the result of the accumulation.

The SUHCF control system supplied by the Government was rewired to work more directly with the PWWWRS system, eliminating one panel of relays.

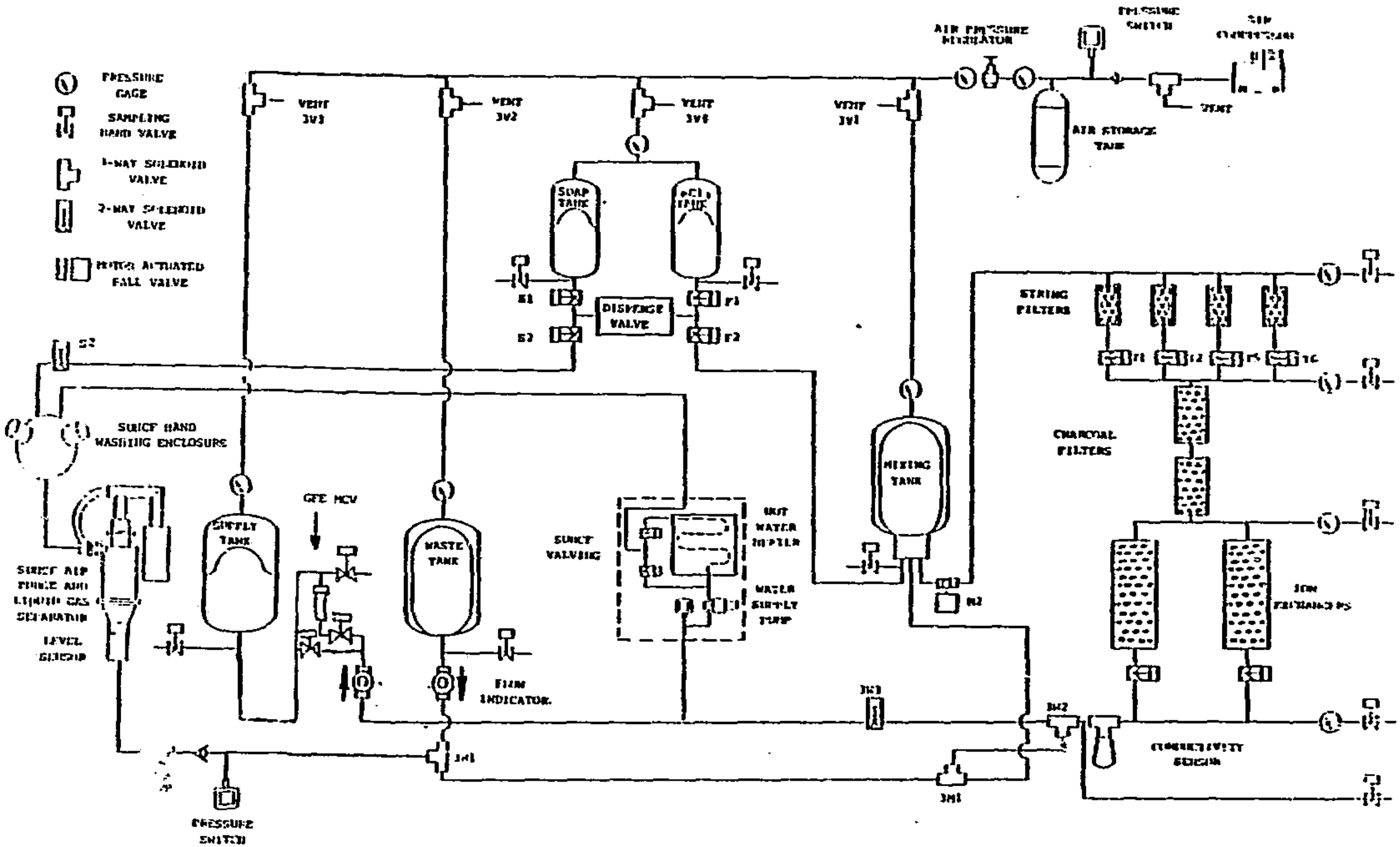
The dispensing valve system was disassembled to clean the valve seats which had accumulations of soap.

The microbial check valve GFE80508 was installed in the discharge water line leading to the water supply tank as shown on Flow Diagram Figure 7 on the following page.

A by-pass line with valves provided access for taking water samples before and after the MCV.

Start-Up Procedure

The procedure for loading the system and starting the system was reviewed and revised to conform to changes in the control wiring system. The maintenance manual is revised to include the new version procedure.



FLOW DIAGRAM PWWRS/SUHCF SYSTEM
WITH GFE MICROBIAL CHECK VALVE

FIGURE 7

3.3.1 GENERATION OF TRACE ORGANICS AND EVALUATION OF THE GFE MICROBIAL CHECK VALVE

The analysys of the GFE Microbial Check Valve to the Prototype Wash Water Waste Renovation System was completed, as discussed in Task 3.4. An extended test program/mission simulation was conducted. In addition to producing reclaimed water within the tentative wash water standards per Table III, there were two major objectives of this extended test program.

1. To regenerate the organics found in the previous effort which were not removed by the adsorbers for analysis.
2. To evaluate the operation of the system with the GFE Microbial Check Valve installed in the product water line.

The extended operation of the system was scheduled during which data on water use and pressure drop were monitored. The final product water was analyzed midway and upon completion of the mission simulation. The analysis included soap content, conductivity, resistivity, pH, total organic carbon and number of microorganisms per cubic centimeter.

The water, spiked with trace amounts of salts, glucose, urea and lactic acid, Table IV, was poured into the hand cleansing bowl along with soap. Ferric chloride was automatically dispensed to the mix chamber during each cycle. The extended test program involved (19) nineteen treatment cycles with a total quantity of 57 gallons (215.76 liters) of water passing through the system. The system was a closed loop except for the addition of contaminates described previously.

The test program was conducted until enough residual organics were generated, that were not removed by the adsorbers, for analysis. Assuming 0.4 lbs of water per wash and 20 washes per day, the extended test program was equivalent to a 57 day mission simulation.

The procedure followed during the test was as follows:

1. The supply tank was charged with 7 gallons of distilled water, pH 5.9.
2. The soap tank was charged with 1 gallon of soap solution, pH 10.1 (15% SB-40).

3. The ferric chloride tank was charged with 1 gallon of $FeCl_3$ solution, pH 3.0 (3.60% $FeCl_3$).
4. Water from the supply tank was discharged to fill a 1/2 gallon jar 4.17 lbs water - allowing approximately ten 0.4 pound washes.
5. Ten shots of soap solution (2 ml nominal/shot) were collected in a jar at the soap nozzle and added to the 1/2 gallon water.
6. Ten shots of $FeCl_3$ solution (2 ml nominal/shot) dispensed concurrently with the soap by the dispenser valve were automatically fed to the mixing chamber in normal operation.
7. The 1/2 gallon of soap-water mix was spiked by the addition of 4 mls of a mixed salt masterbatch solution.
8. The spiked, soap water mix was poured into the wash basin, drained into the air/water separator sump and transferred to the waste tank.
9. This process was repeated until 3 gallons were in the waste tank.
10. At this point in the test, the unit was switched to treatment/transfer mode and the 3 gallons were transferred to the mixing tank.
11. After a 5-minute delay for flocculation to occur, the mixture in the mixing tank was run through the filter system back to the supply tank.
12. The above process was repeated for the duration of the extended test program until a total of 54 gallons had been processed through the unit.
13. The final 3 gallons of water processed, 57 gallons total, was passed through the GFE Microbial Check Valve while in route to the supply tank.
14. During the course of the extended test program, some of the original 7 gallons of supply water was lost either as retained samples or during filter cartridge replacement, (T5 filter) and ion exchange replacement (T3) prior to treatment cycles 17 and 15 respectively.

The results of the extended test program are tabulated in Table V.

TABLE III

TENTATIVE WASH WATER STANDARDS

Total Organic Carbon (TOC), MG/L	200
Specific Conductivity, UMHO-CM^{-1}	2000
pH	5 to 7.5
Ammonia, Mg/L	5
Turbidity, ppm SIO_2	10
Color, PT-C Units	15
Foaming	Nonpersistent more than 15 sec.
Odor	Nonobjectionable
Total Dissolved Solids (TDS), Mg/L	1500
Urea, Mg/L	50
Lactic Acid, Mg/L	Reference Only
NACL, Mg/L	1000
Microorganisms, Number per ML	0

TABLE IV

SYNTHETIC WASH WATER FORMULATION

Materials	Concentration (ppm)
Premixed	
Sodium Chloride	50.00
Sodium Sulfate	30.00
Copper Sulfate	2.50
Potassium Chloride	15.00
Zinc Chloride	7.50
Glucose	1.40
Lactic Acid	7.00
Urea	10.00
Dispensed	
Soap (solids)	as dispensed by the PWWWRS
Total	123.40 ppm

TABLE V

PERFORMANCE OF PWWWRS DURING EXTENDED OPERATION WITH MICROBIAL CHECK VALVE

Treatment Cycle	Gallons of Water Treated	Cumulative Gallons of Water Treated	Psig Waste Tank	Filters & Absorbers in Use	P, psig Across Filters	P, psig Across Deionizer	Soap Content of Water ppm	Water Analysis of Final Product Water: Salt Content of Water: Conductivity Micro mhos cm-1	Resistivity ohm-cm	ppm as NACl	pH	TOC ppm	Microorganisms per C.C. Before MCV	Microorganisms per C.C. After MCV
1	3	3	30	T_2 T_3	0	0								
2	3	6	30	T_2 T_3	3	0								
3	3	9	30	T_2 T_3	26	1								
4	3	12	30	T_2 T_3	20	1								
5	3	15	30	T_2 T_3	20	2								
6	3	18	30	T_2 T_3	24	2								
7	3	21	30	T_2 T_3	12	2								
8	3	24	30	T_1 T_4	20	2								
9	3	27	30	T_1 T_4	18	2	<1	7.93	126,237	4	6.5	9.4		
10	3	30	30	T_1 T_4	19	2								
11	3	33	30	T_1 T_4	21	3								
12	3	36	30	T_5 T_4	9	2								
13	3	39	30	T_5 T_4	19	2								
14	3	42	30	T_5 T_4	21	2								
15	3	45	30	T_5 T_3(1)		1								
16	3	48	30	T_6 T_3	20	1								
17	3	51	30	T_5(2) T_3	8	1								
18	3	54	30	T_5 T_3	10	1								
19	3	57	30	T_5 T_3	10	1	<1	1.16	115,666	<2	6.1	11.5	320	2

(1) New ion exchange resin in deionizer T_3

(2) New Filter in T_5

3.3.2 PROBLEMS ENCOUNTERED DURING EXTENDED TEST PROGRAM/MISSION SIMULATION

Two problems were observed and remedied during the extended test program which were not observed in previous testing programs.

1. Unbalanced delivery of soap and $FeCl_3$. This problem was the result of an accumulation of buildup on the solenoid valve seats in the soap and $FeCl_3$ lines. The problem was remedied by cleaning and reassembly of the valve seats.

2. Lot to lot variations of the SB-40 soap. This problem was observed prior to the extended test program. A one gallon sample of SB-40 soap was obtained for use in the test program. Prior to mission simulation, the soap and $FeCl_3$ stoichometry were routinely checked before addition to the Prototype Wash Water Waste Renovation System. This lot of soap required additional $FeCl_3$ than observed in past experiments for optimum soap removal.

   Three additional soap samples were obtained from Rochester Germicide, each from a different production lot. The samples were tested for soap and $FeCl_3$ stoichometry. Two lots were similar to past experiments while one lot required a significantly greater amount of $FeCl_3$.

   In order to insure complete soap removal by the Prototype Wash Water Waste Renovation System, a stoichometry check must be made prior to the addition of soap and $FeCl_3$ to the tanks. The $FeCl_3$ concentrations can be adjusted to give the proper stoichometry on an equal volume basis.

3.4 EVALUATE THE ABILITY OF THE GFE MICROBIAL CHECK VALVE TO ELIMINATE OR MINIMIZE MICROORGANISMS IN THE PRODUCT WATER

The GFE Microbial Check Valve 80508 was installed in the product water line after the conductivity check valve in route to the supply tank. This location is advantageous because only final product water exhibiting low enough conductivity for reuse will be allowed to pass through the microbial check valve.

Sampling stations are provided, both before and after the microbial check valve, along with an alternate microbial check valve by-pass route back to the supply tank. Water samples for microorganism counts were obtained at these stations.

Mission simulation consisted of 19 treatment cycles[a]. Treatments 1-18 recycled 54 gallons of wash water, doped with 2160 cc of 15 percent SB-40 soap and trace amounts of salts. These 18 treatments bypassed the microbial check valve and were routed directly to the supply tank.

Treatment 19 evaluated the effectiveness of the microbial check valve. As in the previous treatments, 3 gallons of supply water was doped with 120cc of SB-40 soap and trace salts. This treatment routed the final product water through the microbial check valve, then back to the supply tank. Water samples for microorganism counts were drained at the sampling stations before, and after the microbial check valve.

The water samples obtained at the sampling stations were examined for number of microorganisms per milliliter of final product water. Standard methods were employed for the microbial count as published in "Standard Methods for the Examination of Water and Wastewater", Twelfth Edition, 1965. Our experimental procedure is known as Standard Plate Count.

Standard Plate Count consists of setting up a series of known dillutions of the water in question. Known volumes of these dillutions are added to petri dishes along with 10-15 mls of liquified standard plate count agar. The agar and water is mixed thoroughly together, then allowed to solidify. After solidification, the petri dishes are inverted and incubated for 48 hours at 20°C.

a. Refer to Table V page 18

After incubation, plates containing 30-300 colonies are selected for direct counting. All colonies are counted using sufficient magnification so they may be located. These numbers are then adjusted according to dilutions made in preparation.

The direct counting reveals the effectiveness of the microbial check valve. Water sampled before entry into the microbial check valve contained 320 microorganisms per milliliter of product water, while water exiting the valve contained less than 2 microorganisms per milliliter. Our experiment proves the microbial check valve greater than 99.4 percent efficient.

APPENDIX

FOR TASK 3.1

3.1.5. TABLE OF FIGURES

* no direct matches with our library search were found

Figure Number	Description
3g	Upper: DIP-MS of blank Lower: Mass spectrum taken at 3.7 min (MS1)
3h	Mass spectrum taken at 12.3 min (MS2) (large fragments at m/z 446, 447, 448 can be attributed to diffusion pump oil)
4	Upper: DIP-MS - total ion (TI) current profile and three extracted iontograms (at m/z, 45, 74, 89) characteristic for lactic acid Lower: Mass spectrum of lactic acid
5	Upper: DIP-MS total ion and extracted iontograms for three fragments characteristic for urea (m/z 43, 44, 60) Lower: Mass spectrum of urea
6a	DIP-MS profile of water residue iontograms extracted at m/z 149 (typical for phthalates)
6b	Mass spectra (MS1, MS2) taken at 4.1 min and 5.9 min
6c	Mass spectra MS1' and MS2' (MS1 and MS2 with subtracted background)
6d	Spectral library search for MS1'
6e	Spectral library search for MS2' (Both searches in Figs. 6d and 6e were unsuccessful for matching phthalates, because larger alkyl fragments from lanolin were masking the correct library hits.)

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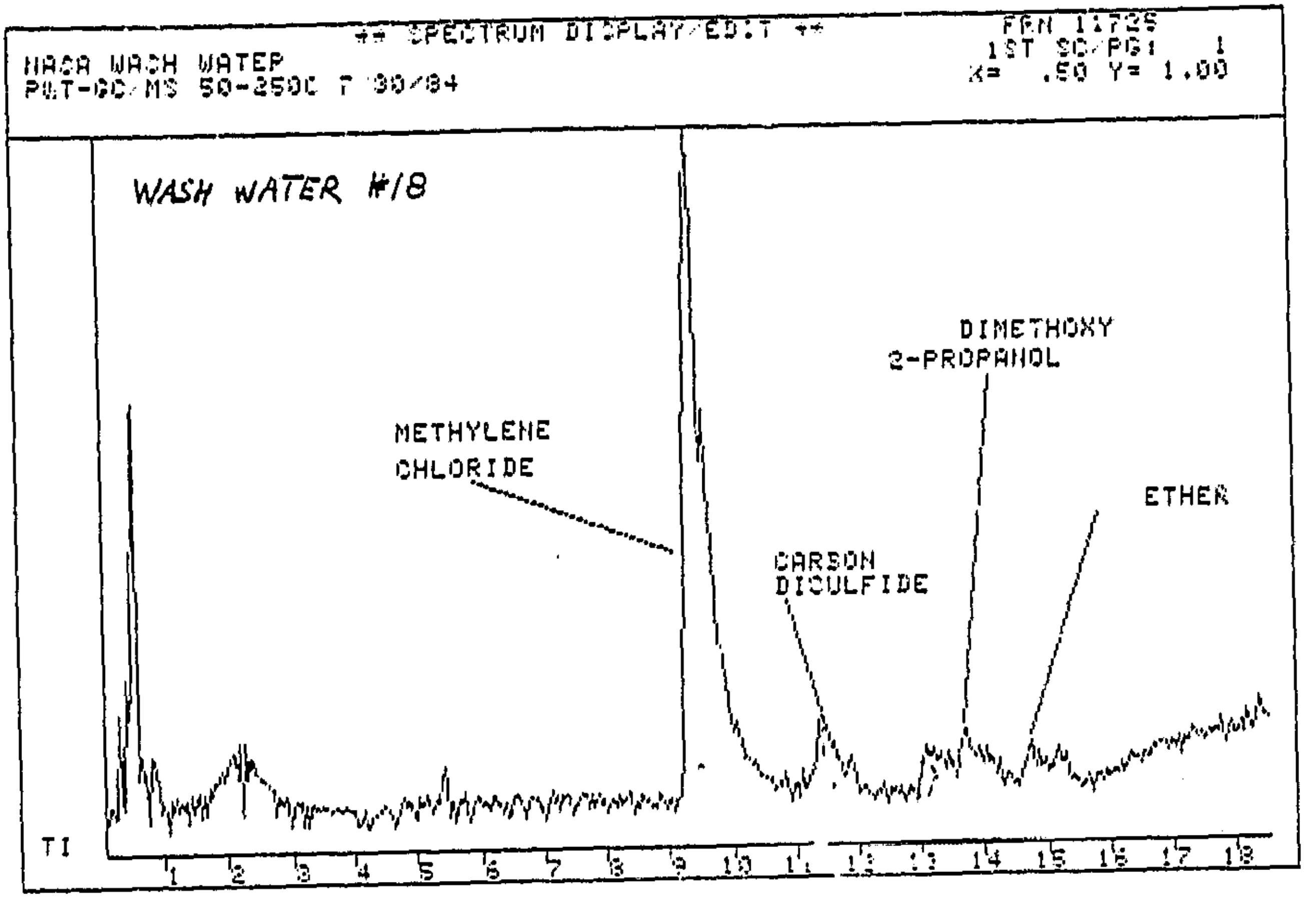

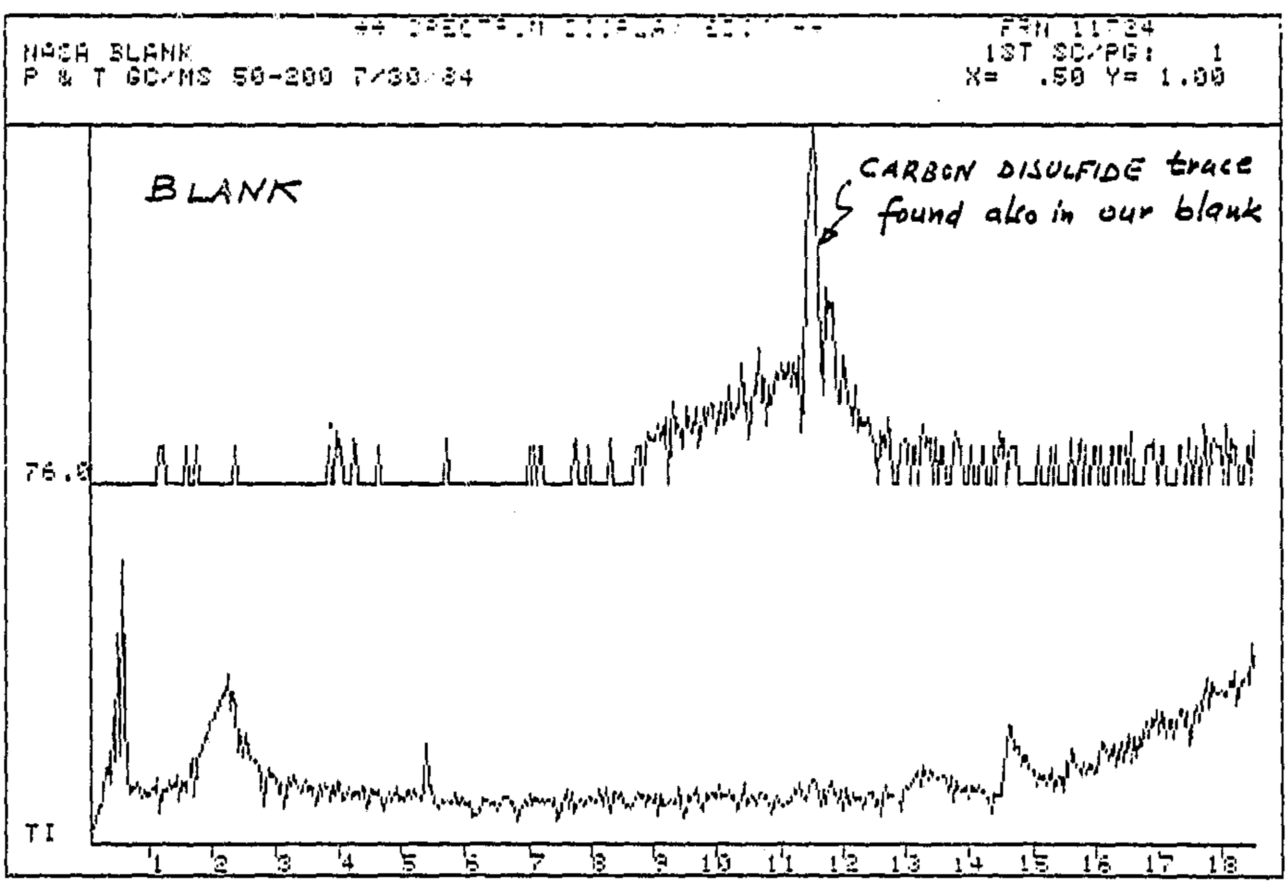

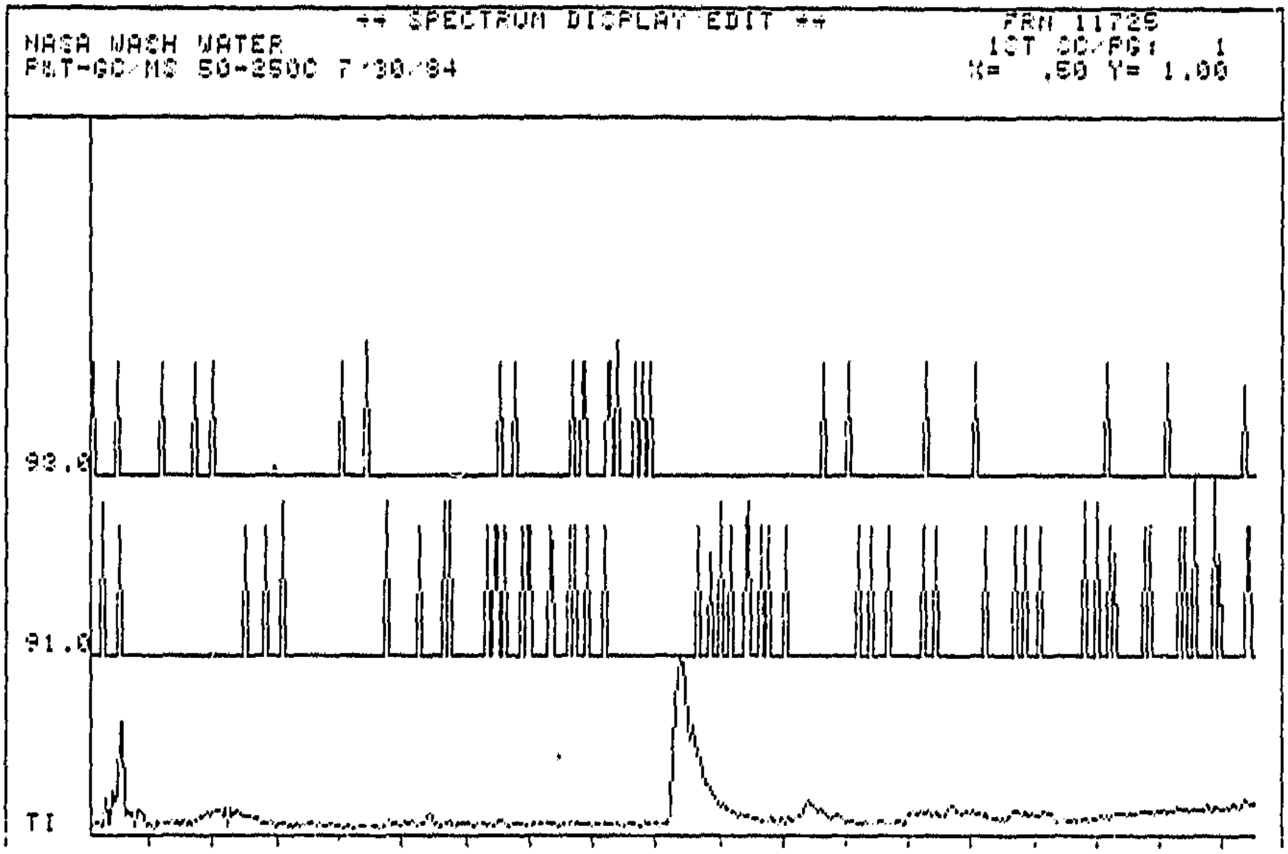
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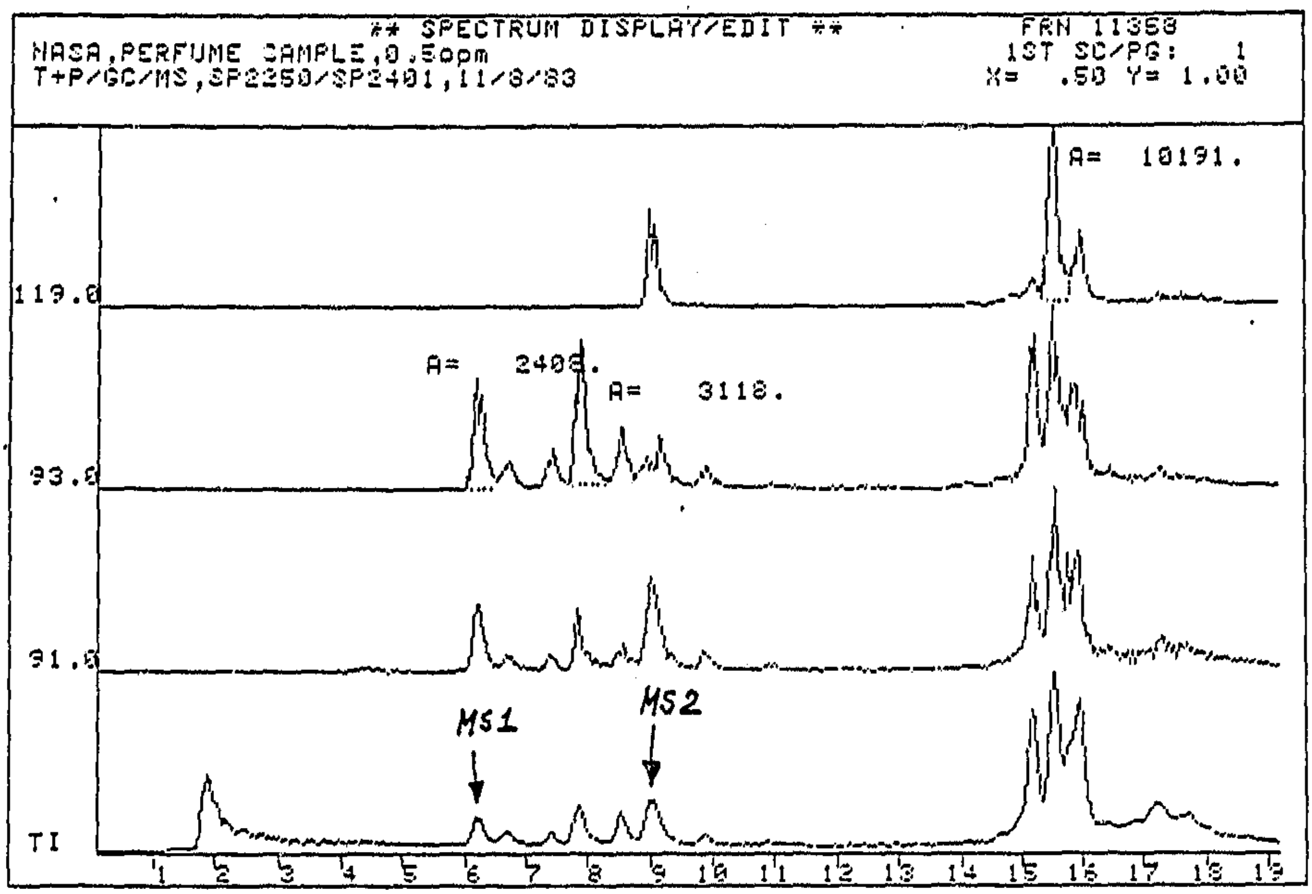
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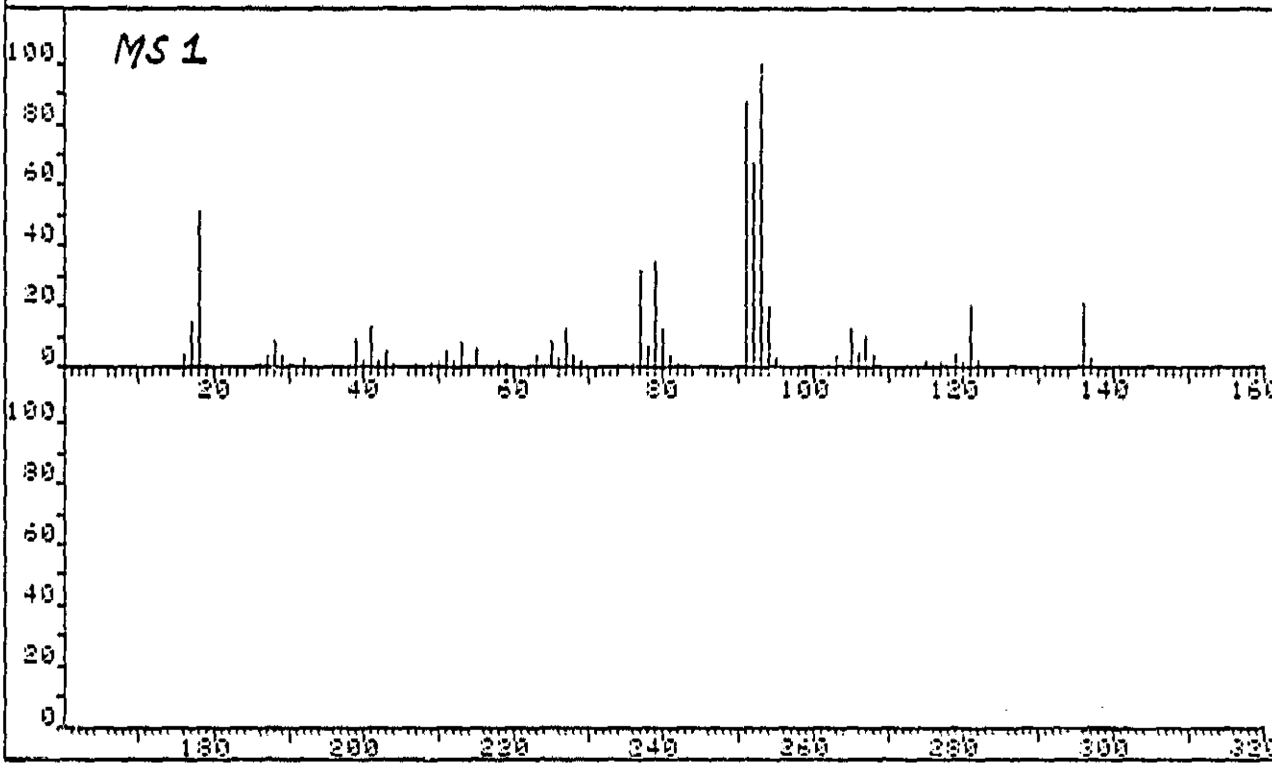


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          FRN = 3005 [NBS    6529.]  CAS #   0056666503   EPA #  0000036807
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           15.4  10  17%     .0   0   0%      .0   0   0%  MULTIPLIER=  .45

 .9757     Benzeneacetic acid, .alpha.-hydroxy- (9CI)
          SPEC=  662  LSN=  6421. MW= 152   C8H8O3
          FRN = 3005 [NBS    6421.]  CAS #   0000090642   EPA #  0000004888
          MATCHING PEAKS    CONTAMINATED    MISSING PEAKS  QUAL INDEX=  728
           13.4   8  17%     .0   0   0%      .0   0   0%  MULTIPLIER=  .35

 .9755 +   Cyclobutene, 2-propenylidene- (9CI)
          SPEC=  757  LSN=   757. MW=  92   C7H8
          FRN = 3002 [NBS     757.]  CAS #   0052097855   EPA #  0000029595
          MATCHING PEAKS    CONTAMINATED    MISSING PEAKS  QUAL INDEX=  568
           13.8   9  29%     .0   0   0%      .0   0   0%  MULTIPLIER=  .81

 .9742 +   Benzene, methyl- (9CI)
          SPEC=  750  LSN=   750. MW=  92   C7H8
          FRN = 3002 [NBS     750.]  CAS #   0000108883   EPA #  0000019587
          MATCHING PEAKS    CONTAMINATED    MISSING PEAKS  QUAL INDEX=  738
           12.7   8  28%     .0   0   0%      .0   0   0%  MULTIPLIER=  .68

 .9703     3-Cyclobutene-1,2-dione, 3,4-dihydroxy- (9CI)
```

```
 FRN 11357             SPECTRUM  219              RETENTION TIME     9.0
LARGST 4:      119.2,100.0      91.1, 35.0     134.1, 23.9      117.2, 15.7
LAST 4:        136.2,  1.5     137.1,   .2     139.2,   .9      154.2,  1.6
                                                              PAGE 1   Y =  1.00
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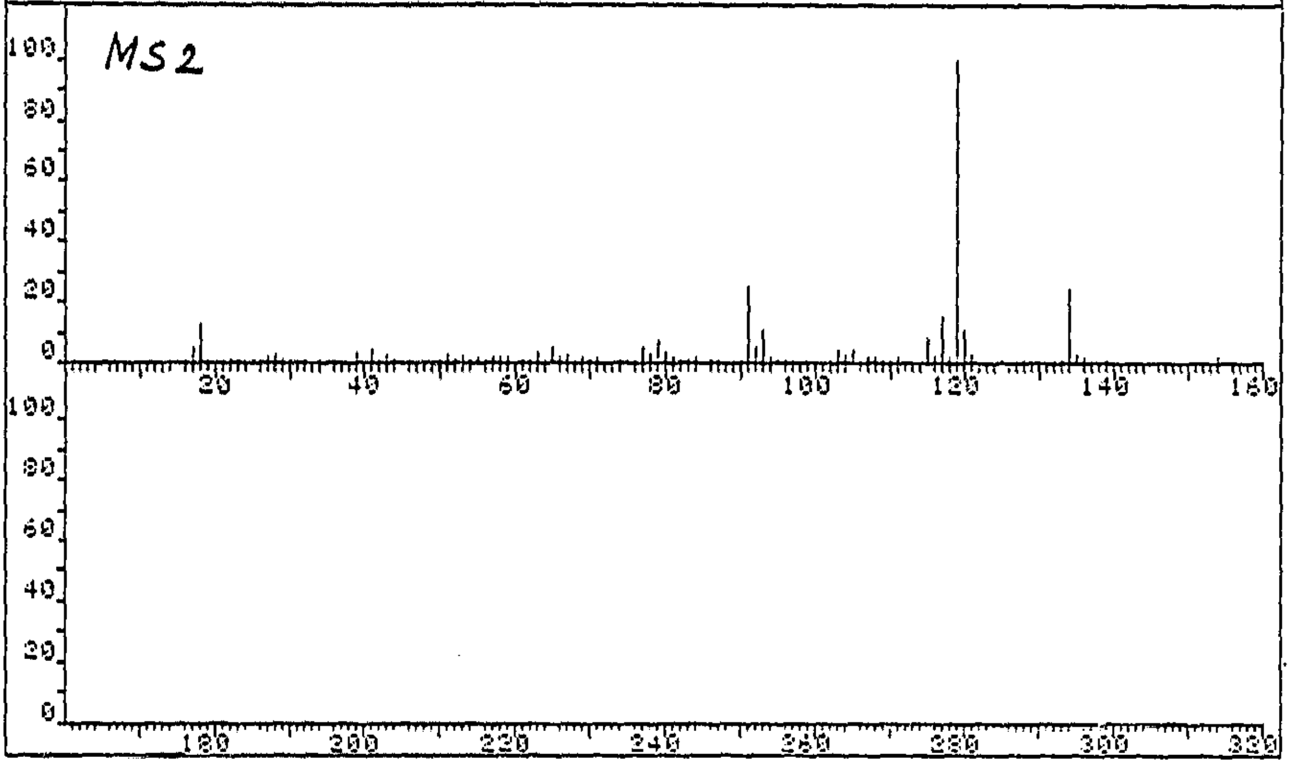


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LIBRARIES FOR SEARCH? N
LOW AND HIGH MOLECULAR WEIGHT LIMITS?        [    1.0_ 9999.0] 119,180
USE DEFAULT SEARCH OPTIONS?                  Y
WORKING...

REF.  SPECT #=  219  LSN=   219. MW=    0  FRN=11357   RET. TIME=   9.0
          94 PEAKS,     50 SIGNIFICANT        MAX K   19.8

 LIBRARY  3000   8018 SPECTRA SEARCHED,    10 HIT(S)

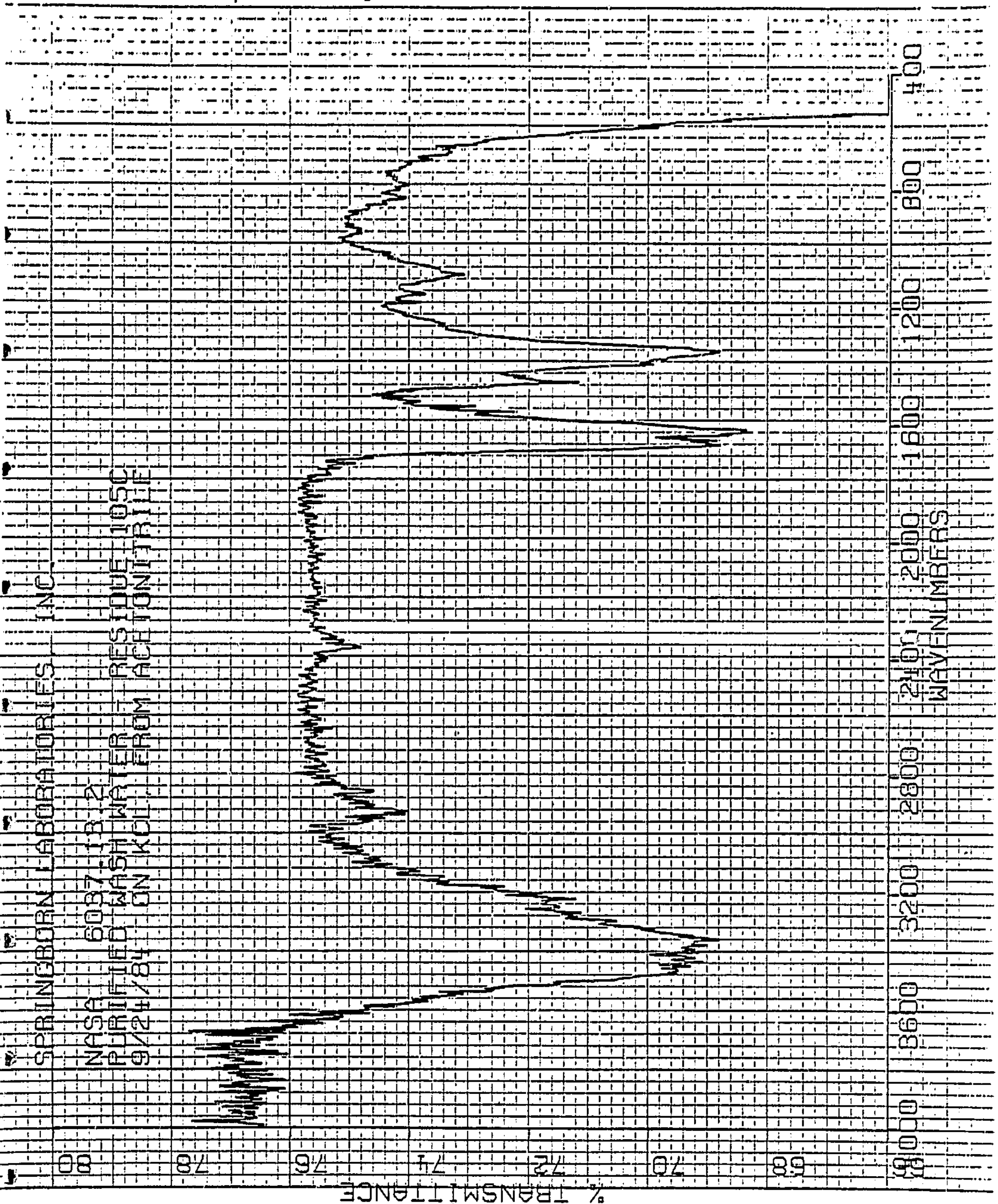

 .9810 +  Benzene, 1-methyl-3-(1-methylethyl)- (9CI)
         SPEC= 3923  LSN=  3923. MW= 134  C10H14
         FRN = 3002 [NBS   3923.]  CAS #  0000535773   EPA #  0000003134
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
          19.6  10  61%    .0   0   0%     .0   0   0%  MULTIPLIER= 1.00

 .9809 +  Benzene, 1-methyl-2-(1-methylethyl)- (9CI)
         SPEC= 3922  LSN=  3922. MW= 134  C10H14
         FRN = 3002 [NBS   3922.]  CAS #  0000527844   EPA #  0000003133
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
          19.4  10  60%    .0   0   0%     .0   0   0%  MULTIPLIER= 1.00

 .9807 +  Benzene, 1-methyl-4-(1-methylethyl)- (9CI)
         SPEC= 3914  LSN=  3914. MW= 134  C10H14
         FRN = 3002 [NBS   3914.]  CAS #  0000099876   EPA #  0000003135
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
          19.2  10  60%    .0   0   0%     .0   0   0%  MULTIPLIER= 1.00

 .9784    Benzene, (1,1-dimethylbutyl)- (8CI)
         SPEC= 2142  LSN=  7901. MW= 162  C12H18
         FRN = 3005 [NBS   7901.]  CAS #  0001985575   EPA #  0000034512
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
          16.6   9  49%    .0   0   0%     .0   0   0%  MULTIPLIER=  .67

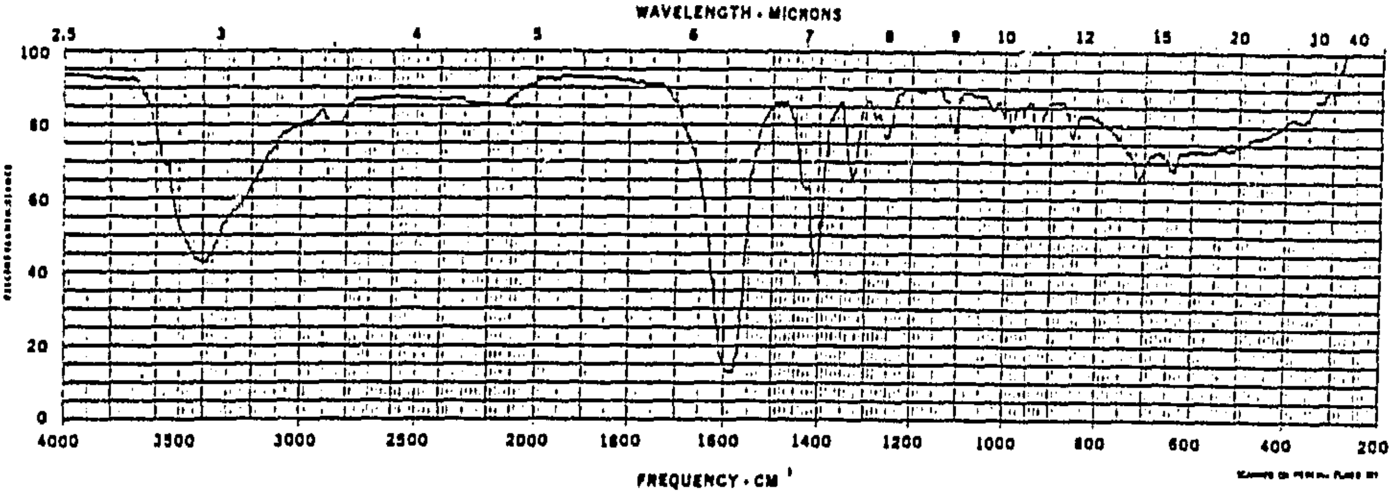
 .9780 +  Ethanone, 1-(methylphenyl)- (9CI)
```


SPRINGBORN LABORATORIES INC.
NASA 6037 IB 2
PURIFIED WASH WATER RESIDUE 105C
9/24/84 ON KCL FROM ACETONITRILE
4000 3600 3200 2800 2400 2000 1600 1200 800 400
WAVENUMBERS
80 78 76 74 72 70 68
% TRANSMITTANCE

SEQUESTRENE Na_2Ca RECRYST. 1891

DISODIUM CALCIUM ETHYLENEDIAMINETETRAACETIC ACID

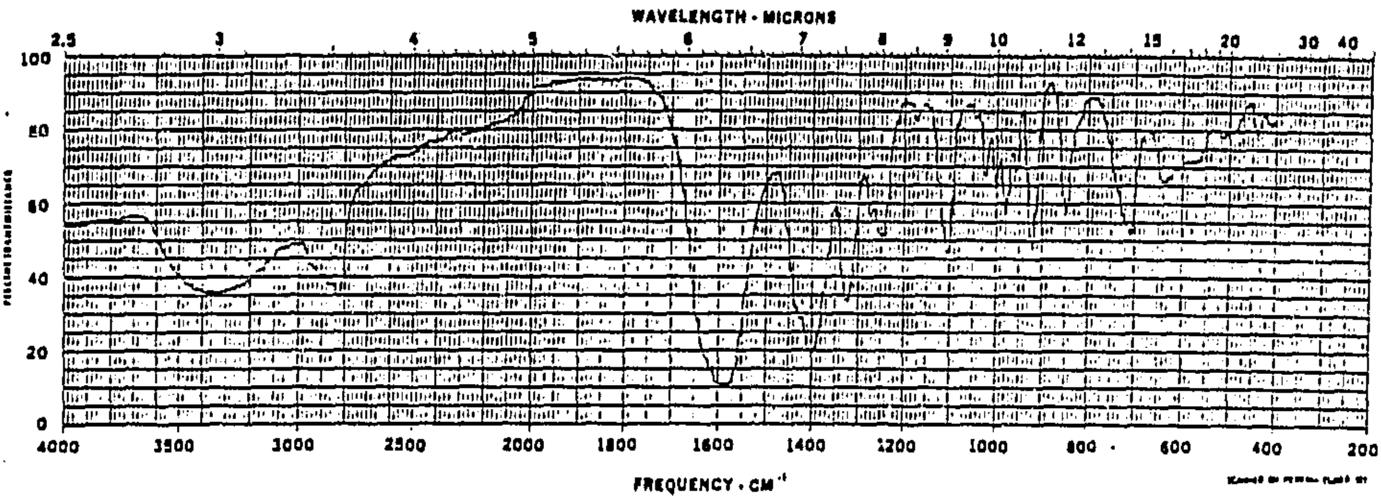
KBr Wafer Source: CIBA-GEIGY Corporation, Dyestuffs and Chemicals Division



SEQUESTRENE Na_2Ca 1892

DISODIUM CALCIUM ETHYLENEDIAMINETETRAACETIC ACID

Film (Cast from AgCl) Source: CIBA-GEIGY Corporation, Dyestuffs and Chemicals Division



VERSENE CA CHELATING AGENT 1893

CALCIUM DISODIUM ETHYLENEDIAMINETETRAACETATE, DIHYDRATE

KBr Wafer Source: The Dow Chemical Company

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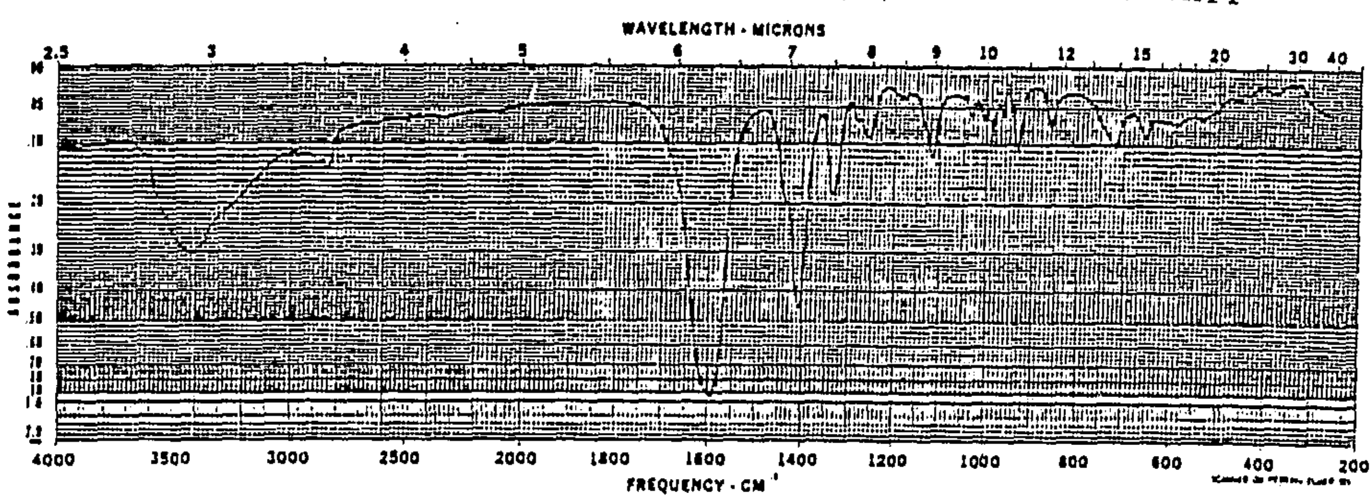
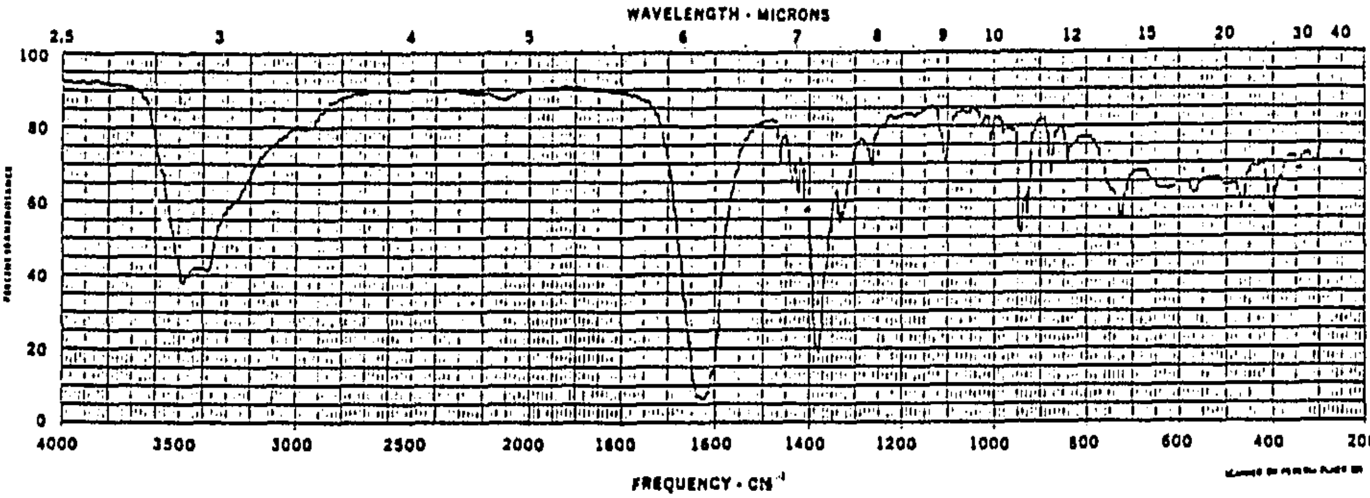


SEQUESTRENE NaFe — 1894

SODIUM FERRIC ETHYLENEDIAMINETETRAACETIC ACID

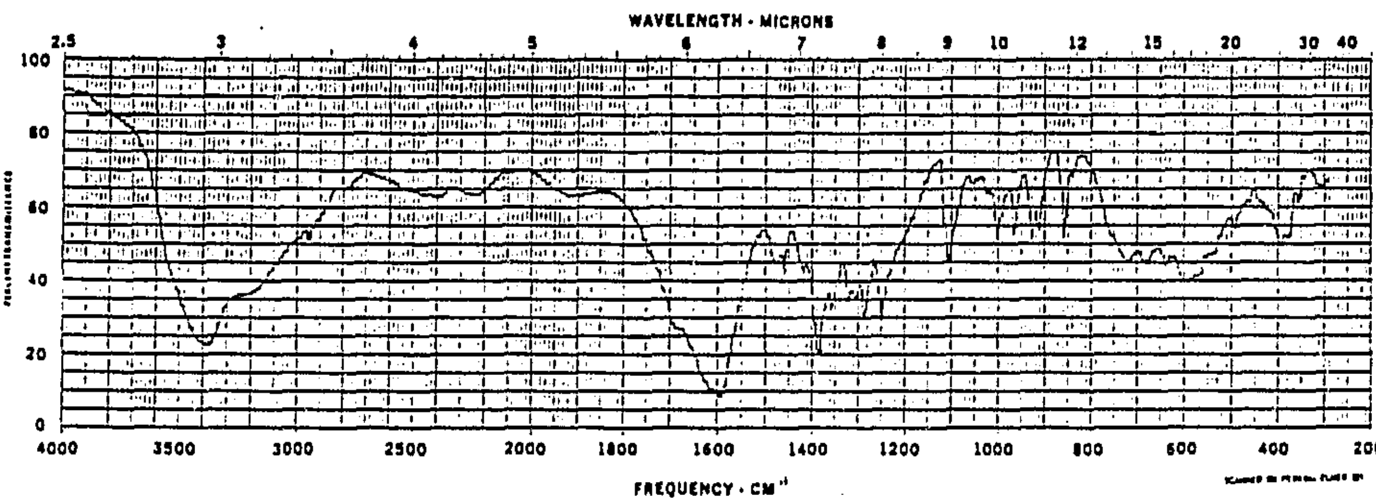
KBr Wafer — Source: CIBA-GEIGY Corporation, Dyestuffs and Chemicals Division



SEQUESTRENE H_2Fe — 1895

ETHYLENEDIAMINETETRAACETIC ACID, FERROUS SALT

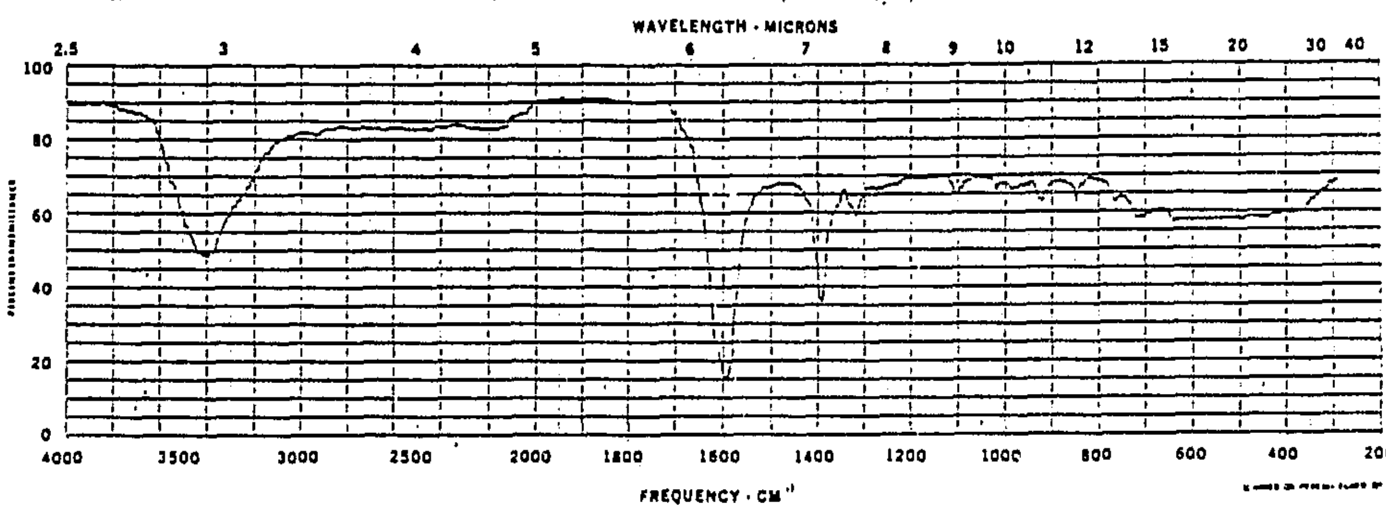
KBr Wafer — Source: CIBA-GEIGY Corporation, Dyestuffs and Chemicals Division



SEQUESTRENE Na_2Co — 1896

DISODIUM COBALTOUS ETHYLENEDIAMINETETRAACETIC ACID

KBr Wafer — Source: CIBA-GEIGY Corporation, Dyestuffs and Chemicals Division



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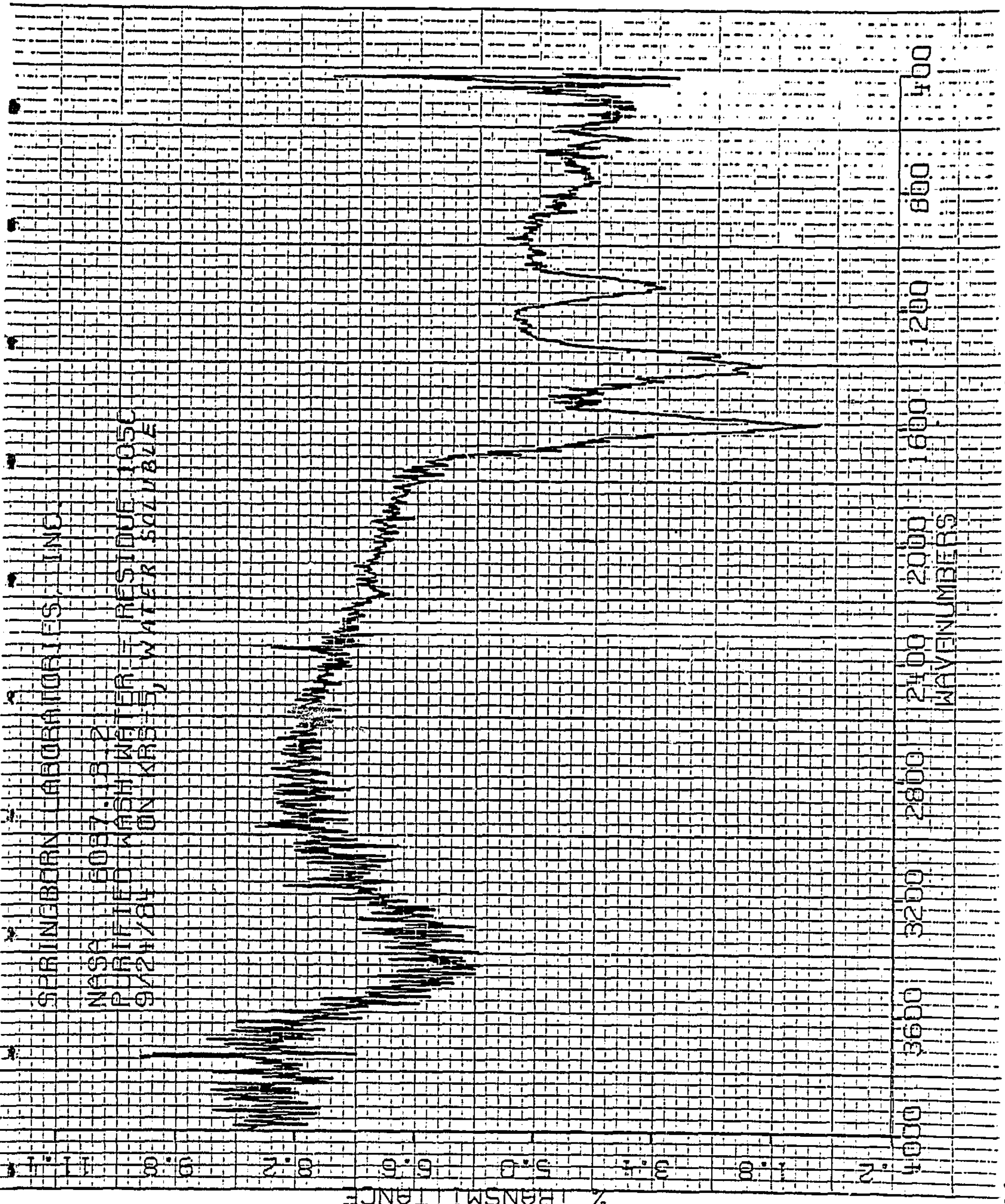
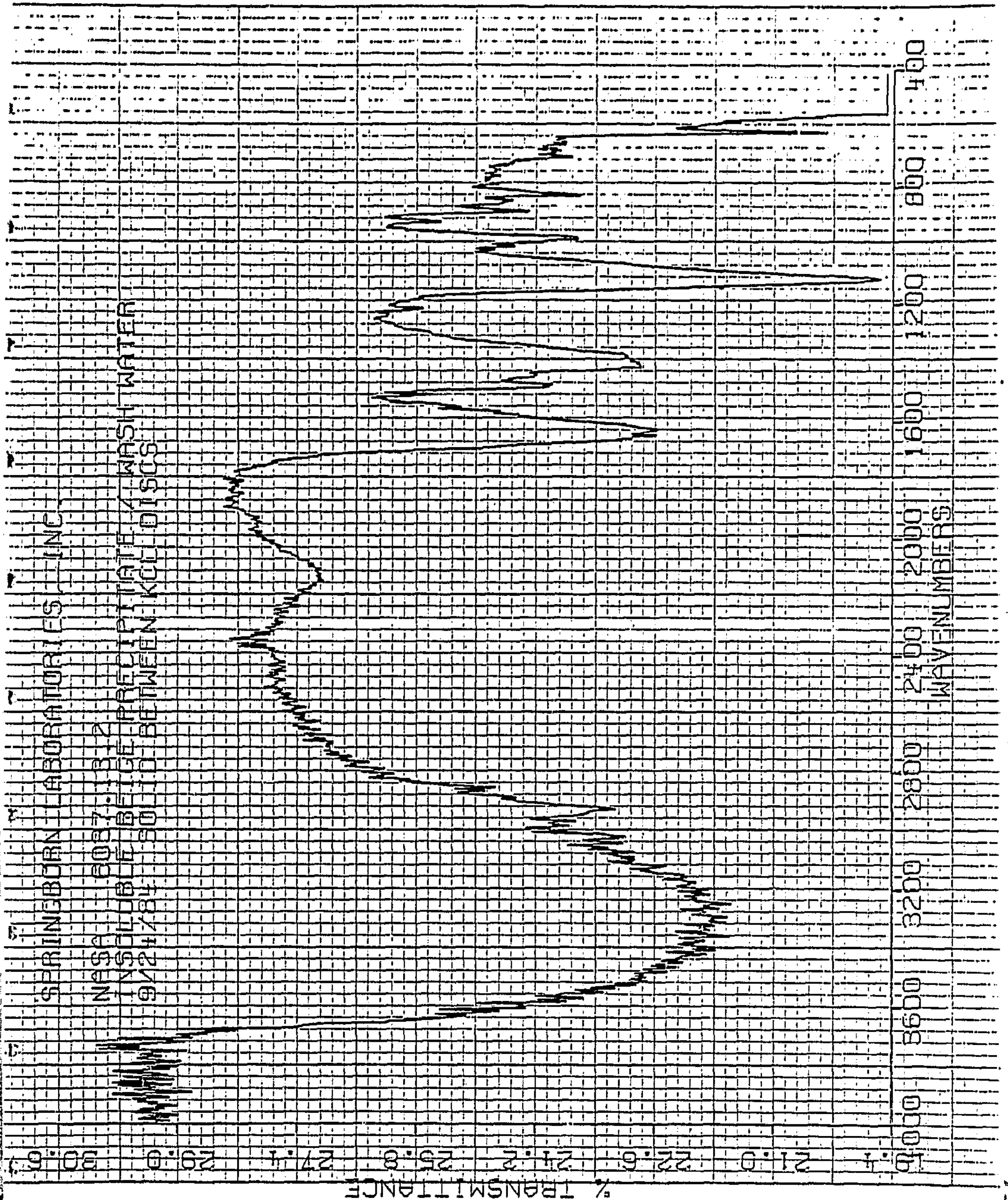
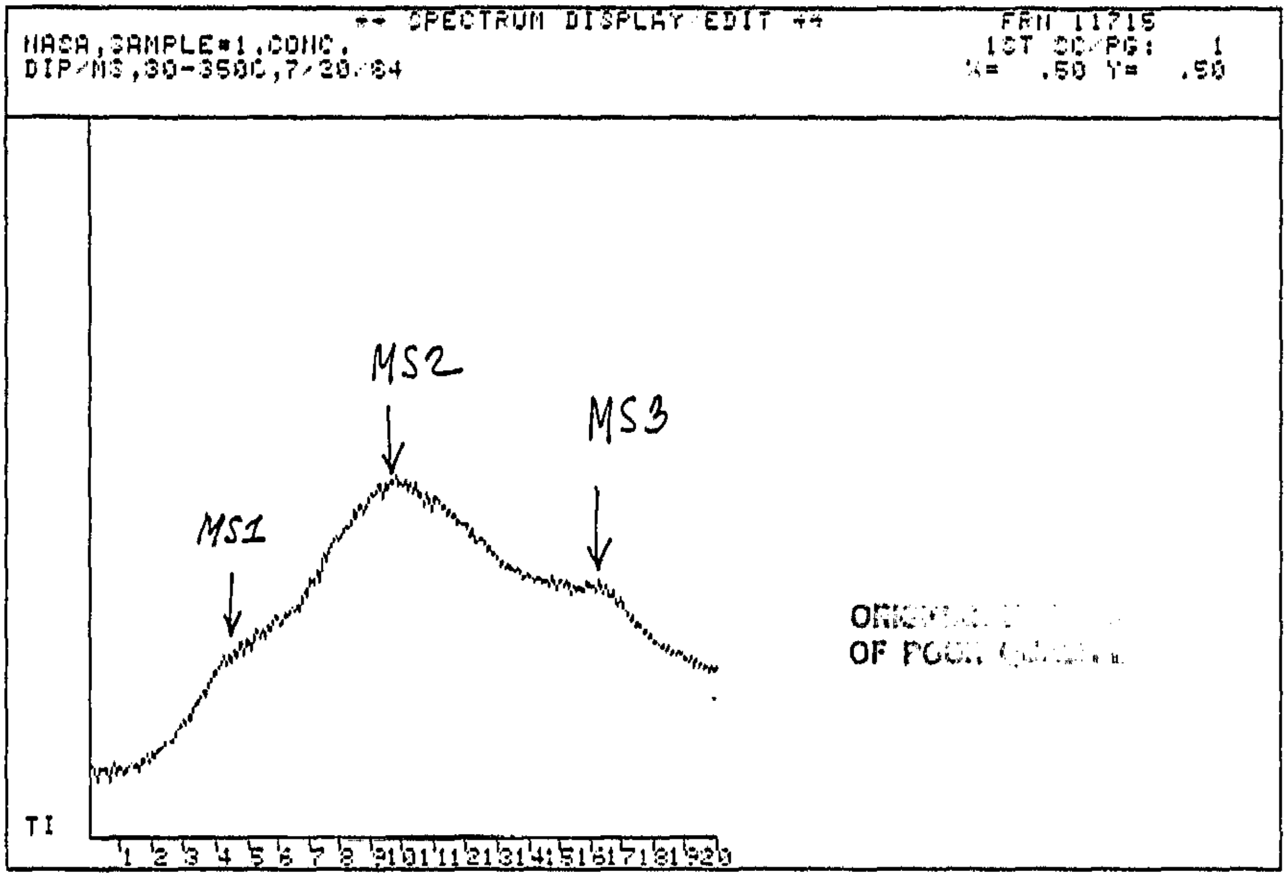
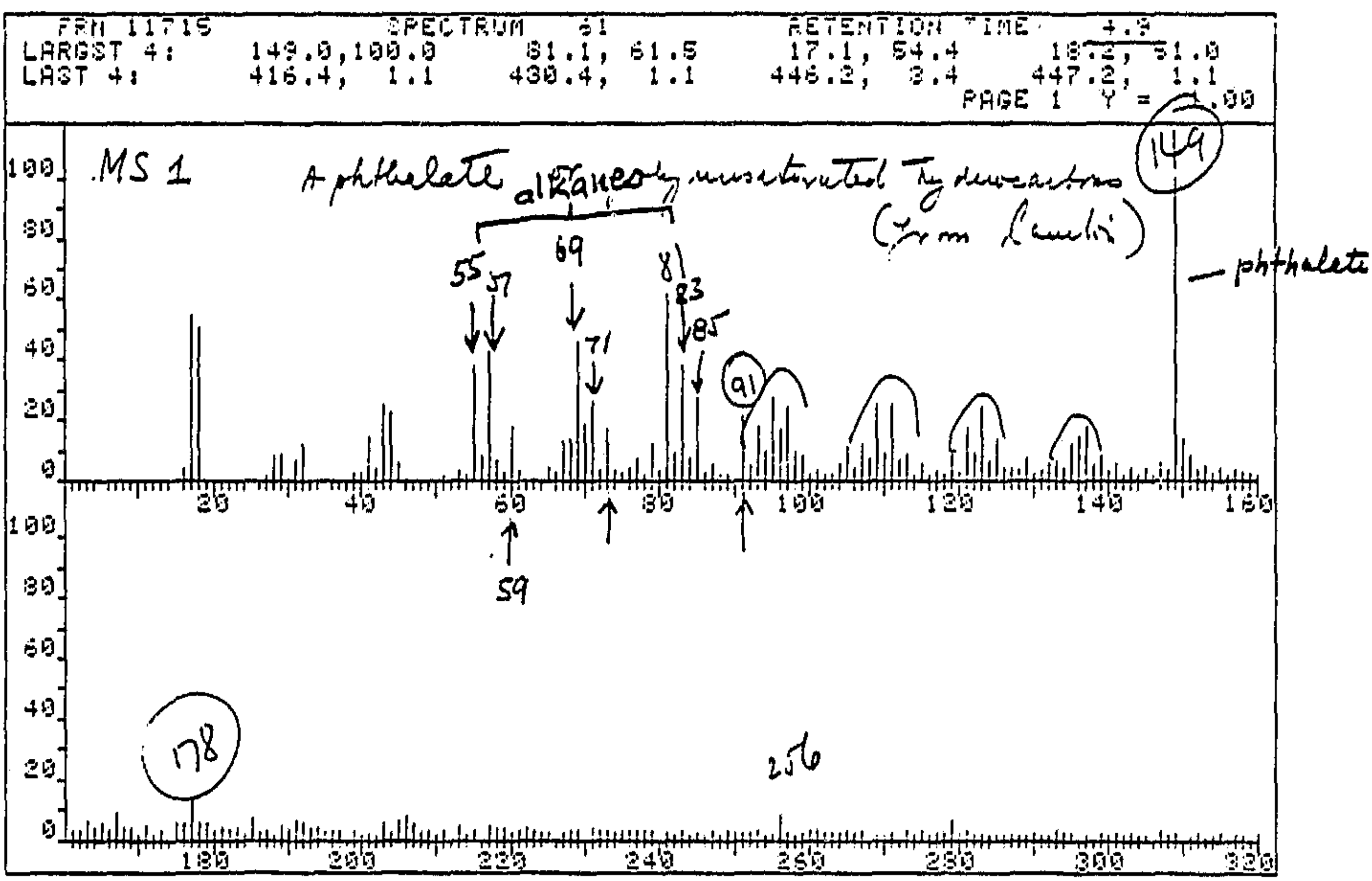
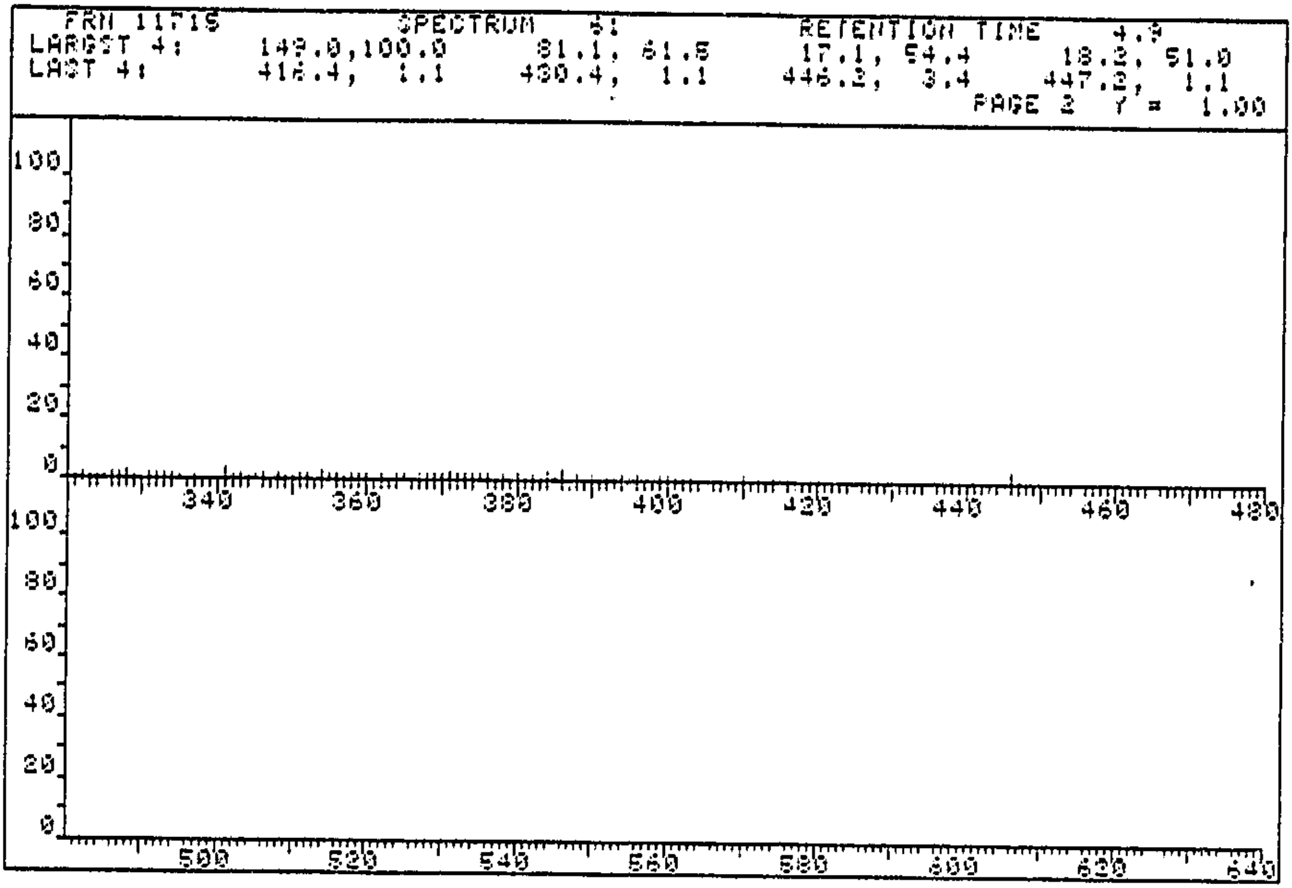


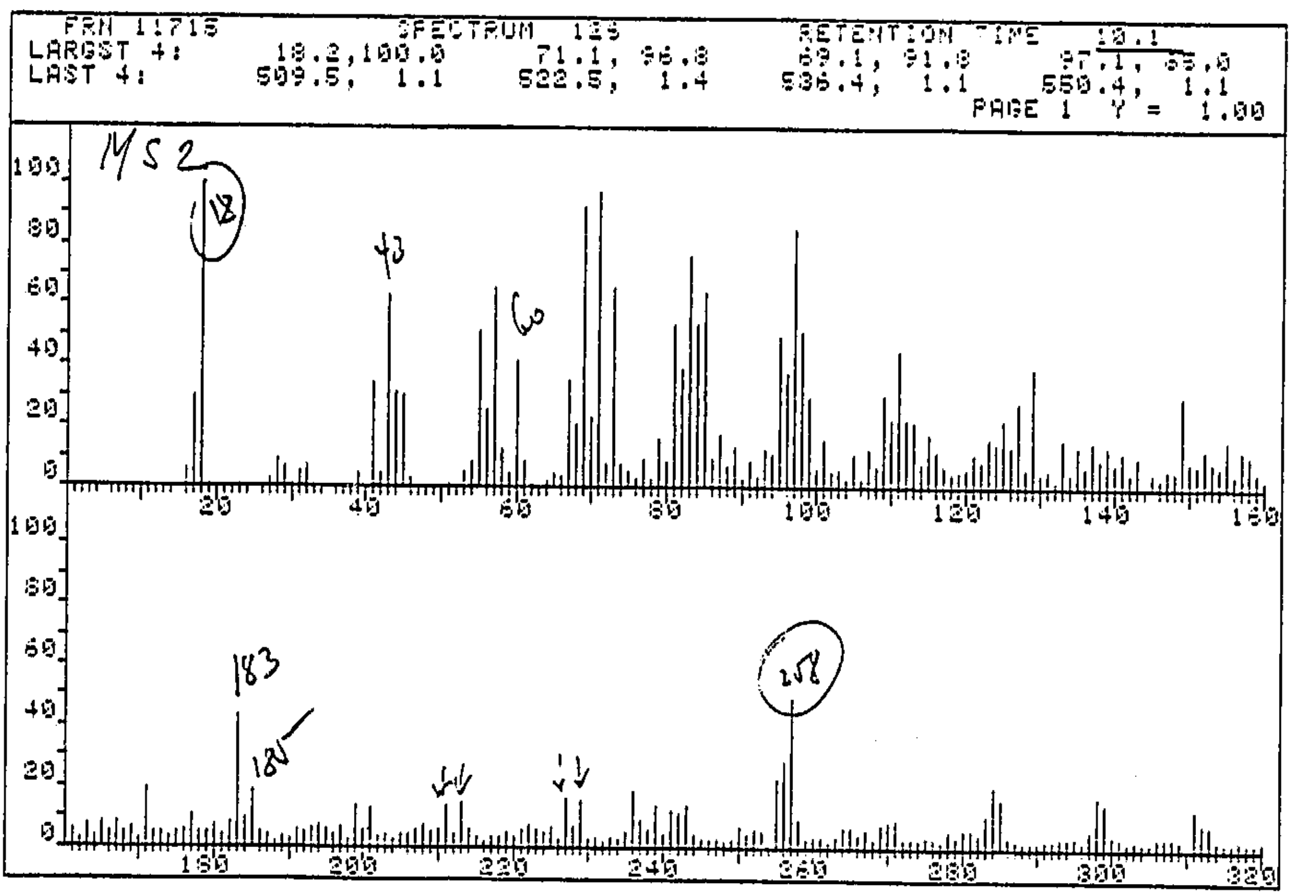

SPRINGBORN LABORATORIES, INC
NASA 6087-3-2
INSOLUBLE BLUE PRECIPITATE / WASH WATER
9/24/84 SOLID BETWEEN KCL DISCS
4000
3600
3200
2800
2400
2000
1600
1200
800
400
WAVENUMBERS
30.6
29.0
27.4
25.8
24.2
22.6
21.0
% TRANSMITTANCE

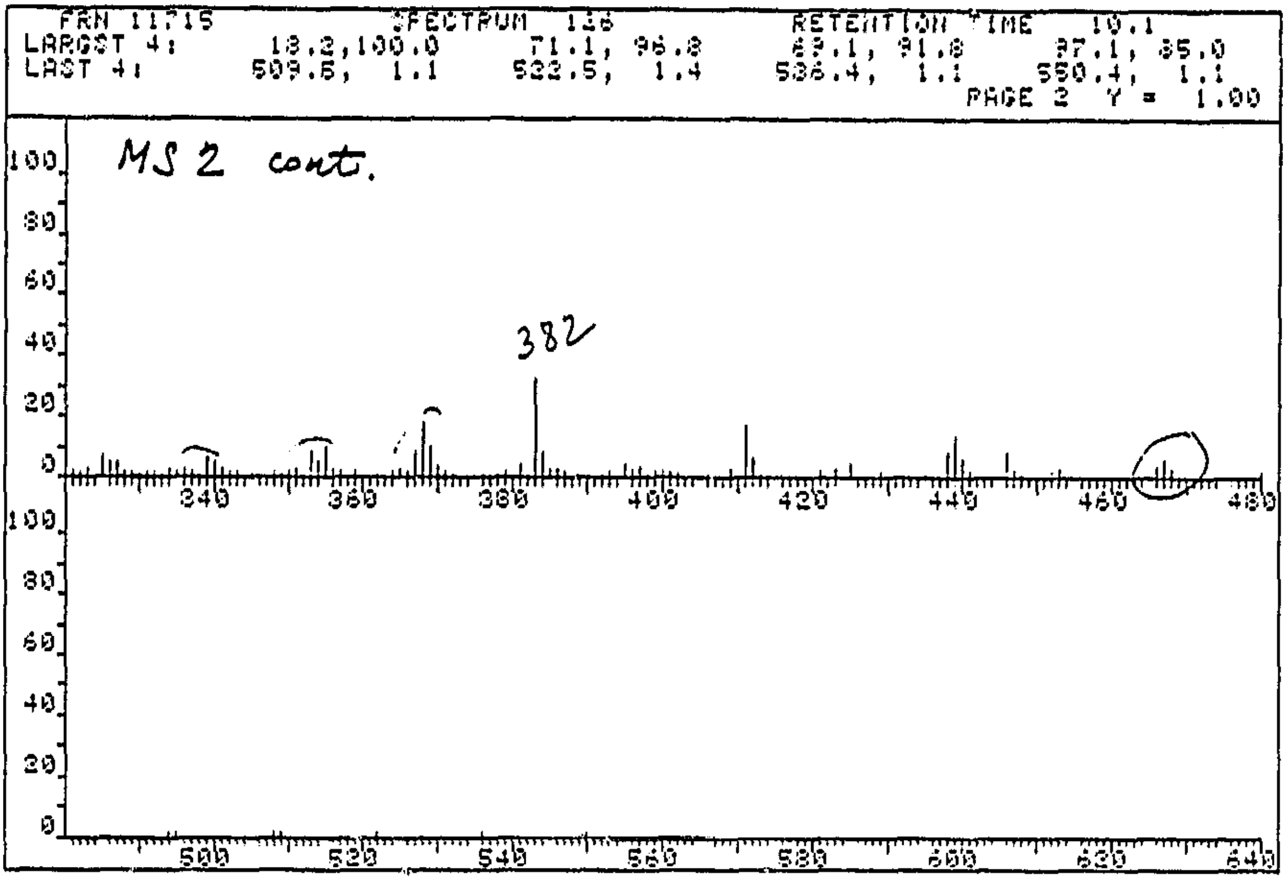
ORIGINAL PAGE IS
OF POOR QUALITY






FRN 11715 SPECTRUM 61 RETENTION TIME 4.9
LARGST 4: 149.0,100.0 81.1, 61.5 17.1, 54.4 18.2, 51.0
LAST 4: 416.4, 1.1 430.4, 1.1 446.2, 3.4 447.2, 1.1
PAGE 2 Y = 1.00


FRN 11715 SPECTRUM 125 RETENTION TIME 10.1
LARGST 4: 18.2,100.0 71.1, 96.8 69.1, 91.8 97.1, 85.0
LAST 4: 509.5, 1.1 522.5, 1.4 536.4, 1.1 550.4, 1.1
PAGE 1 Y = 1.00
MS 2
18
43
60
183
185
258



REF. SPECT #= 126 LSN= 126. MW= 0 FRN=11715 RET. TIME= 10.1
378 PEAKS, 376 SIGNIFICANT MAX K 23.6

LIBRARY 3000 3401 SPECTRA SEARCHED, 10 HIT(S)

.9789 5.alpha.-Cholestan-6-one, 3.alpha.-chloro- (8CI)
SPEC= 94 LSN= 28222. MW= 420 C27H45ClO
FRN = 3020 [NBS 28225.] CAS # 0021072866 EPA # 0000048891
MATCHING PEAKS CONTAMINATED MISSING PEAKS QUAL INDEX= 674
18.4 10 5% .0 0 0% .0 0 0% MULTIPLIER= 1.16

.9787 + 5.alpha.-Cholesta-7,9(11)-dien-3.beta.-ol, 14-methyl-, aceta
te (8CI)
SPEC= 666 LSN= 28794. MW= 440 C30H48O2
FRN = 3020 [NBS 28797.] CAS # 0005596021 EPA # 0000048999
MATCHING PEAKS CONTAMINATED MISSING PEAKS QUAL INDEX= 670
17.9 10 3% .0 0 0% .0 0 0% MULTIPLIER= .79

.9786 Ergostane-3,5,6,12,25-pentol, 25-acetate, (3.beta.,5.alpha.,
6.beta.,12.beta.)- (9CI)
SPEC= 1942 LSN= 30070. MW= 508 C30H52O6
FRN = 3020 [NBS 30073.] CAS # 0056053000 EPA # 0000049211
MATCHING PEAKS CONTAMINATED MISSING PEAKS QUAL INDEX= 611
17.2 10 2% .0 0 0% .0 0 0% MULTIPLIER= .39

.9781 Phosphonic acid, (1,4-diaminobutyl)-, pentakis(trimethylsily
l) deriv. (9CI)
SPEC= 2157 LSN= 30285. MW= 528 C19H53N2O3PSi5
FRN = 3020 [NBS 30288.] CAS # 0056211268 EPA # 0000024500
MATCHING PEAKS CONTAMINATED MISSING PEAKS QUAL INDEX= 598
16.5 9 3% .0 0 0% .0 0 0% MULTIPLIER= .54

```
.9776 → Hexacosane, 9-octyl- (9CI)
        SPEC= 1550  LSN= 29678. MW= 478  C34H70
        FRN = 3020 [NBS  29681.]  CAS #  0055429839   EPA #  0000017993
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  611
         16.5  10   8%    .0   0   0%     .0   0   0%  MULTIPLIER= 1.38

.9774 +  Cholesta-9(11),20(22)-diene-3,23-dione, 6-hydroxy-, (5.alpha
        .,6.alpha.)- (9CI)
        SPEC= 3332  LSN= 27902. MW= 412  C27H40O3
        FRN = 3017 [NBS  27905.]  CAS #  0050676998   EPA #  0000048825
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  646
         17.0   9   4%    .0   0   0%     .0   0   0%  MULTIPLIER=  .39

.9773    14,16-Hentriacontanedione (8CI9CI)
        SPEC= 1269  LSN= 29397. MW= 464  C31H60O2
        FRN = 3020 [NBS  29400.]  CAS #  0024724843   EPA #  0000029540
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  611
         16.3   9   3%    .0   0   0%     .0   0   0%  MULTIPLIER=  .54

.9771    Cyclopentane, 1-(2-decyldodecyl)-2,4-dimethyl- (9CI)
        SPEC= 3174  LSN= 27744. MW= 406  C29H58
        FRN = 3017 [NBS  27747.]  CAS #  0055429260   EPA #  0000017092
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  684
         16.8  10   9%    .0   0   0%     .0   0   0%  MULTIPLIER=  .78

.9771 → 1-Dotriacontanol (8CI9CI)
        SPEC= 1314  LSN= 29442. MW= 466  C32H66O
        FRN = 3020 [NBS  29445.]  CAS #  0006624799   EPA #  0000017862
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  525
         16.3  10  10%    .0   0   0%     .0   0   0%  MULTIPLIER= 1.23
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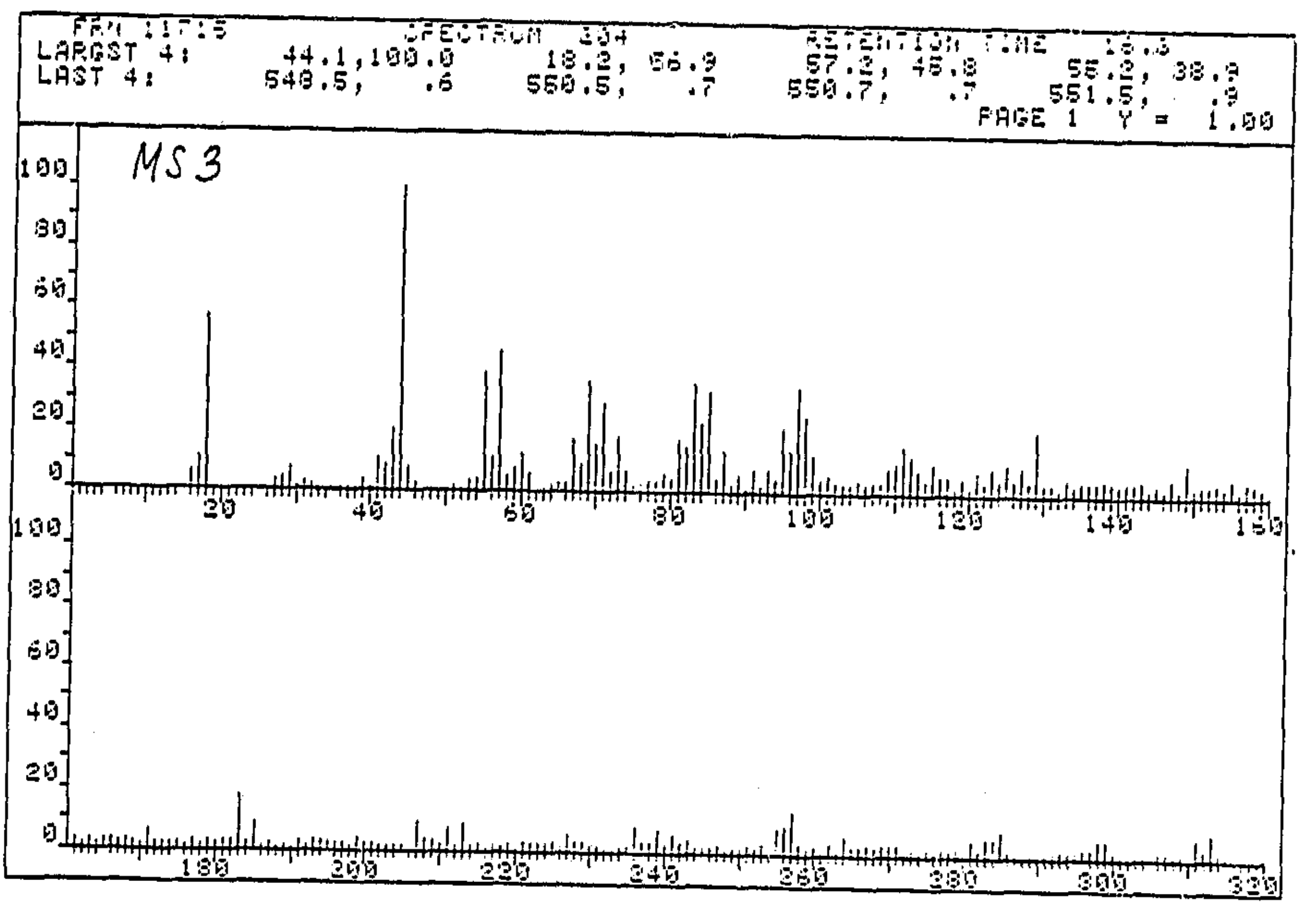

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  FRN 11715            SPECTRUM  204                RETENTION TIME   16.3
LARGST 4:    44.1,100.0      18.2, 56.9       57.2, 45.8       55.2, 38.9
LAST 4:      549.5,   .6     550.5,   .7      550.7,   .7      551.5,   .9
                                                          PAGE 2  Y = 1.00
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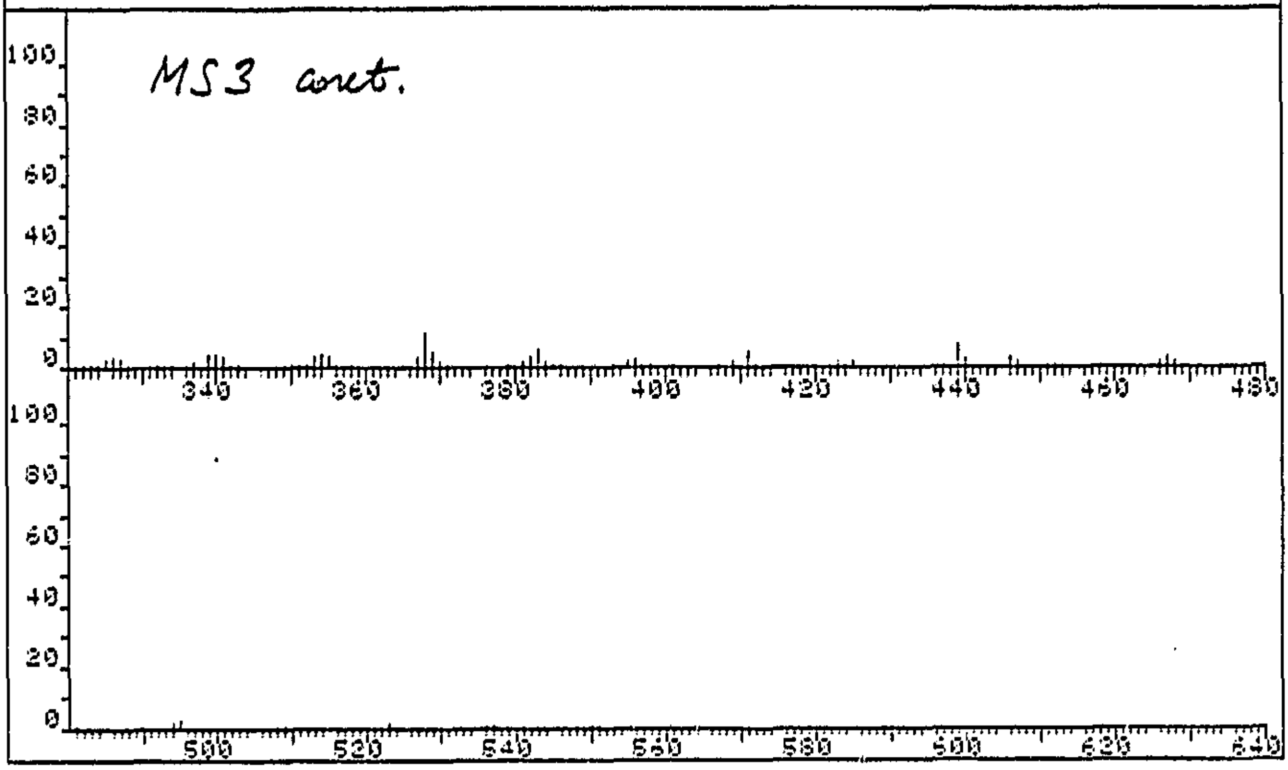


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REF.  SPECT #=  204  LSN=   204. MW=    0  FRN=11715   RET. TIME=  16.3
         364 PEAKS,    278 SIGNIFICANT       MAX K   24.0

 LIBRARY  3000   3401 SPECTRA SEARCHED,    10 HIT(S)


 .9780    Cyclopropa[5,6]stigmast-22-en-3-one, 3',6-dihydro-, (5.beta.
         ,6.alpha.,22E)- (9CI)
         SPEC=  217  LSN= 28345. MW= 424  C30H48O
         FRN = 3020 [NBS  28348.]  CAS #  0053755401   EPA #  0000048906
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  663
          18.0   9   4%     .0   0   0%     .0   0   0%  MULTIPLIER=  .32

 .9778 → Hexadecane, 1,1-bis(dodecyloxy)- (9CI)
         SPEC= 2690  LSN= 30818. MW= 594  C40H82O2
         FRN = 3020 [NBS  30821.]  CAS #  0056554644   EPA #  0000036104
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
          16.1  10  16%     .0   0   0%     .0   0   0%  MULTIPLIER=  .39

 .9769 → 1-Dotriacontanol (8CI9CI)
         SPEC= 1314  LSN= 29442. MW= 466  C32H66O
         FRN = 3020 [NBS  29445.]  CAS #  0006624799   EPA #  0000017862
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  525
          16.3  10  17%     .0   0   0%     .0   0   0%  MULTIPLIER=  .54

 .9766 → 1-Hentetracontanol (9CI)
         SPEC= 2676  LSN= 30804. MW= 592  C41H84O
         FRN = 3020 [NBS  30807.]  CAS #  0040710427   EPA #  0000037863
         MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  675
          14.9   9  15%     .0   0   0%     .0   0   0%  MULTIPLIER=  .54
```

```
        SPEC= 1551  LSN= 29679. MW= 478  C34H70
        FRN = 3020 [NBS  29682.]  CAS #  0055429840   EPA #  0000017991
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  624
         15.8  10   9%     .0   0   0%      .0   0   0%  MULTIPLIER=  .54

.9759    Cycloprop[7,8]ergost-22-en-3-one, 3',7-dihydro-, (5.alpha.,7
        .beta.,8.alpha.,22E)- (9CI)
        SPEC= 3280  LSN= 27850. MW= 410  C29H460
        FRN = 3017 [NBS  27853.]  CAS #  0053755183   EPA #  0000048806
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  537
         15.8   8   4%     .0   0   0%      .0   0   0%  MULTIPLIER=  .35

.9755 --> 17-Pentatriacontene (8CI)
        SPEC= 1745  LSN= 29873. MW= 490  C35H70
        FRN = 3020 [NBS  29876.]  CAS #  0006971400   EPA #  0000018085
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  597
         14.6   9  17%     .0   0   0%      .0   0   0%  MULTIPLIER=  .38

.9755    Palmitic acid, 2-(tetradecyloxy)ethyl ester (8CI)
        SPEC= 1795  LSN= 29923. MW= 496  C32H6403
        FRN = 3020 [NBS  29926.]  CAS #  0028843336   EPA #  0000036186
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
         14.6   8   4%     .0   0   0%      .0   0   0%  MULTIPLIER=  .46

.9754    6H-Dibenzo[b,d]pyran-9-methanol, 1-(acetyloxy)-6a,7,10,10a-t
        etrahydro-6,6-dimethyl-3-pentyl-, acetate, (6aR-trans)- (9CI
        )
        SPEC= 3410  LSN= 27980. MW= 414  C25H3405
        FRN = 3017 [NBS  27983.]  CAS #  0041969624   EPA #  0000031536
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  135
         15.4   8   4%     .0   0   0%      .0   0   0%  MULTIPLIER=  .35

.9747    Nonacosanol (8CI9CI)
        SPEC=  206  LSN= 28334. MW= 424  C29H600
        FRN = 3020 [NBS  28337.]  CAS #  0025154567   EPA #  0000017371
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
         14.6   9  15%     .0   0   0%      .0   0   0%  MULTIPLIER=  .38
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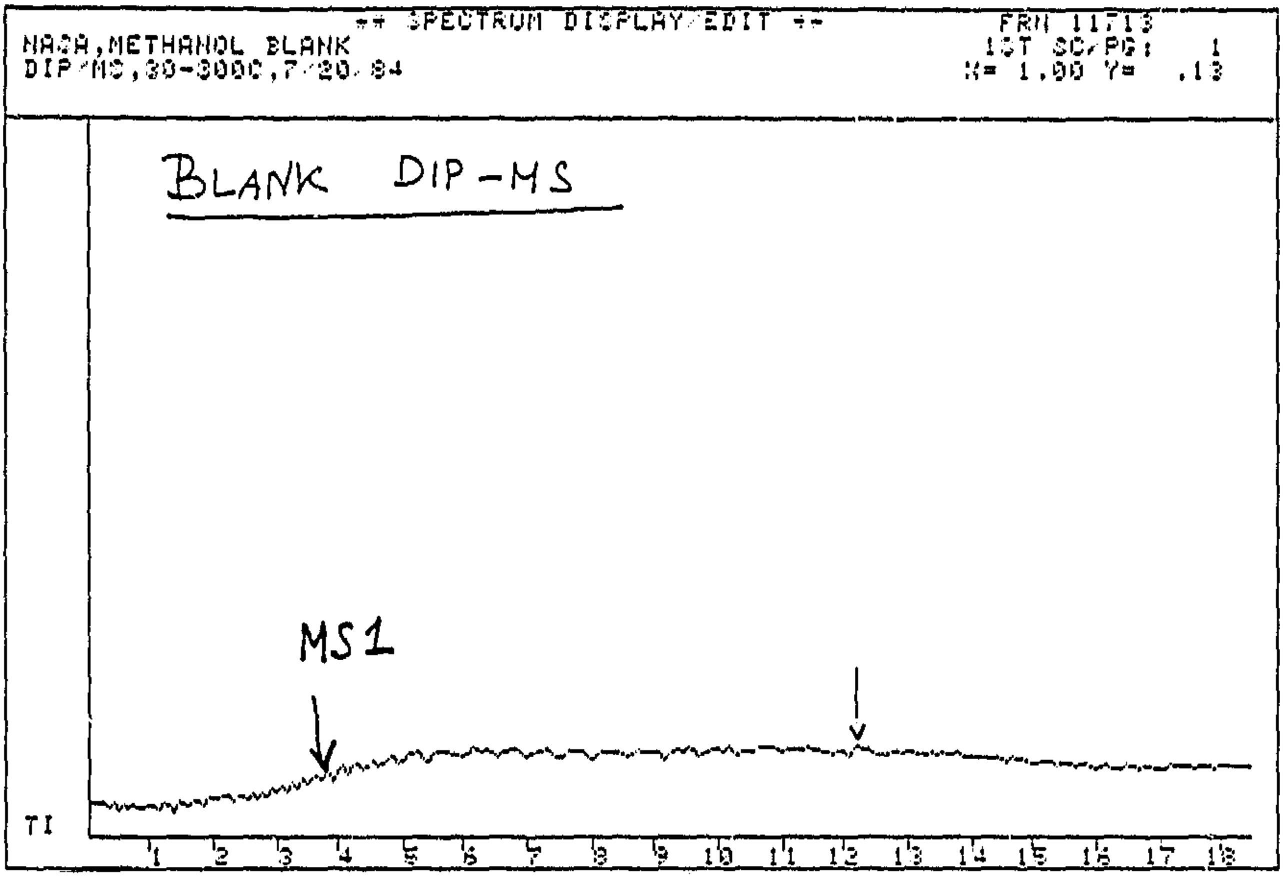
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FRN 11713
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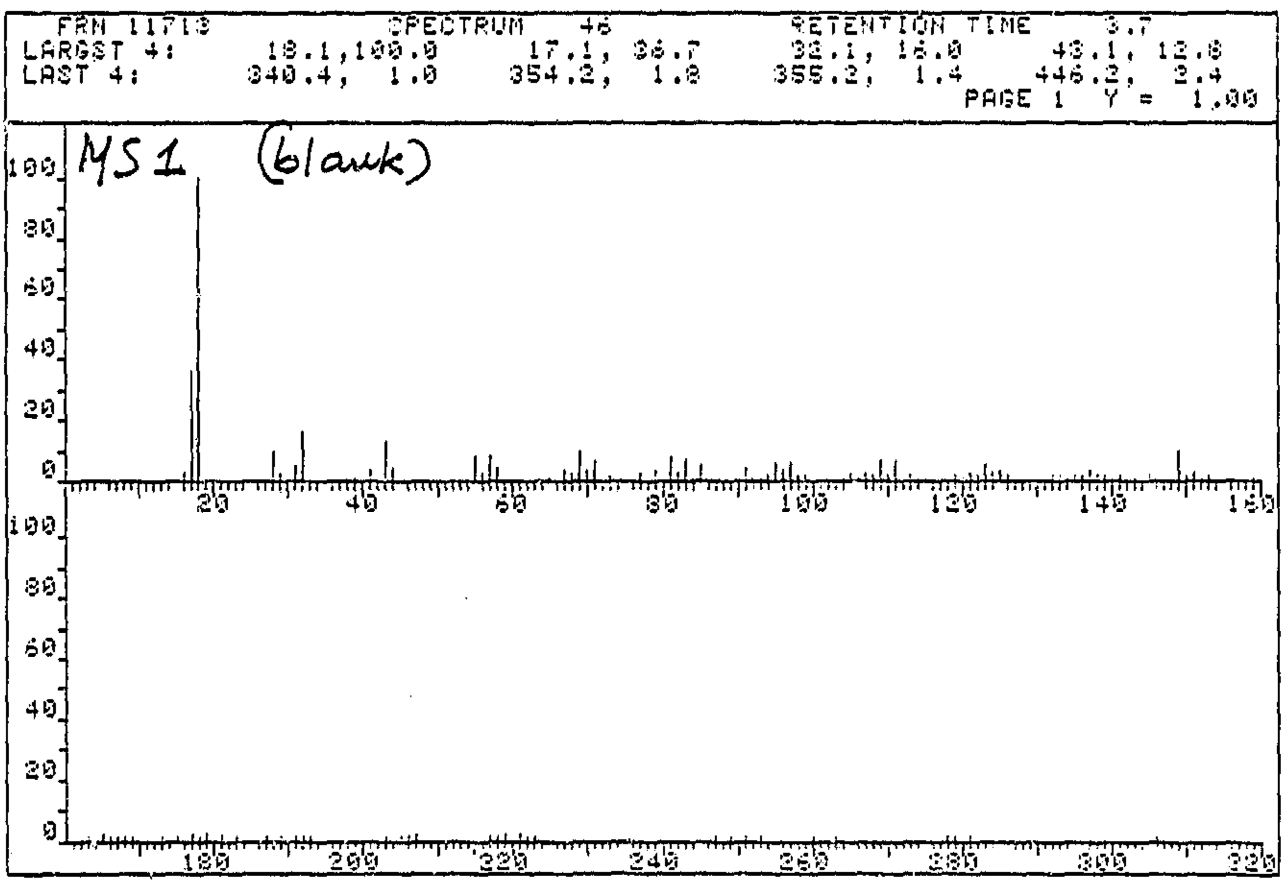
MS1
TI
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18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SPECTRUM 46
RETENTION TIME 3.7
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20 40 60 80 100 120 140 160
180 200 220 240 260 280 300 320

FRN 11713 SPECTRUM 155 RETENTION TIME 12.3
LARGST 4: 446.2,100.0 18.1, 52.2 447.2, 34.4 77.1, 18.3
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PAGE 1 Y = 1.00

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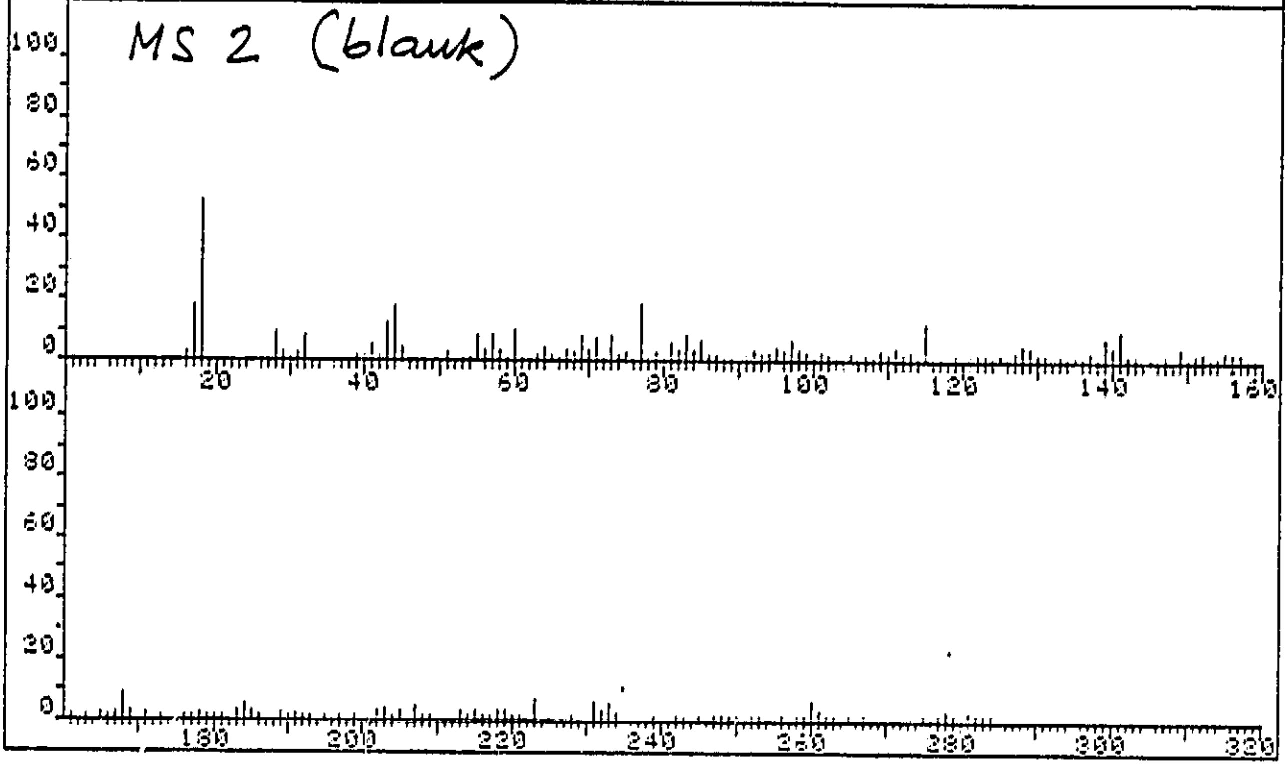

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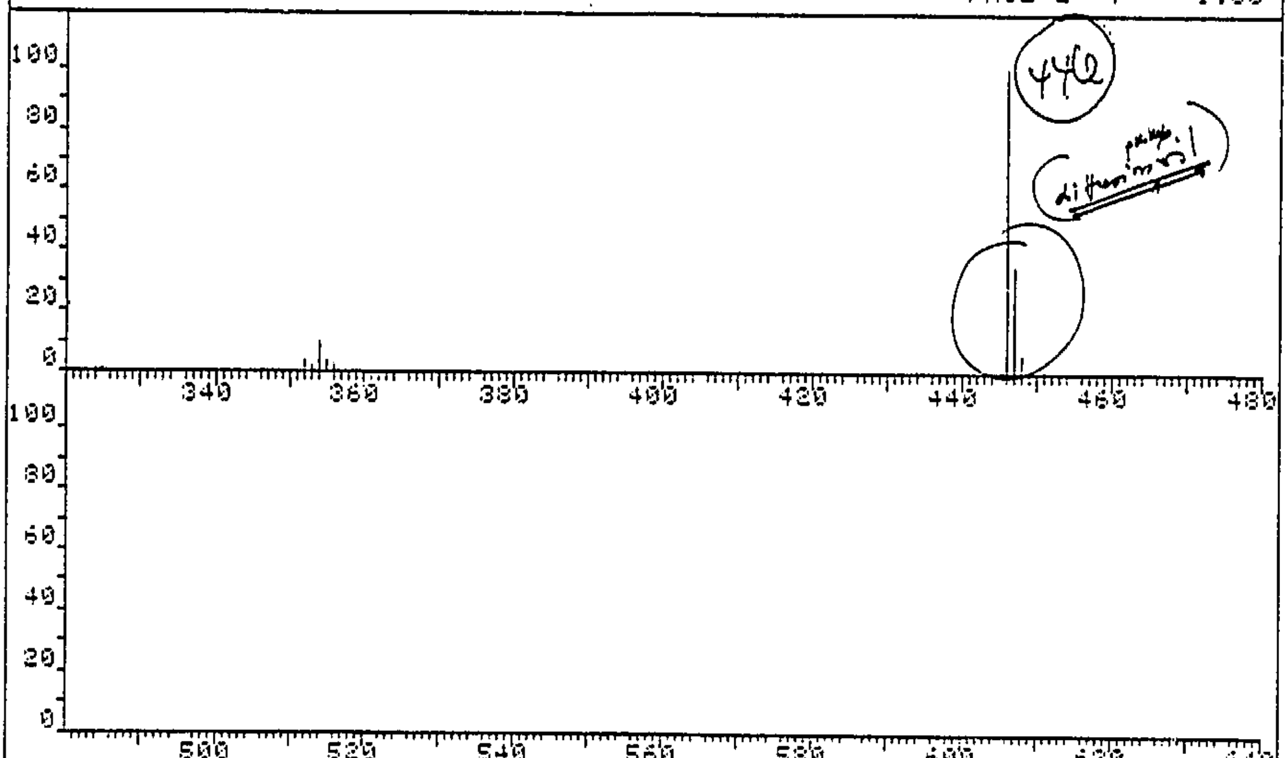
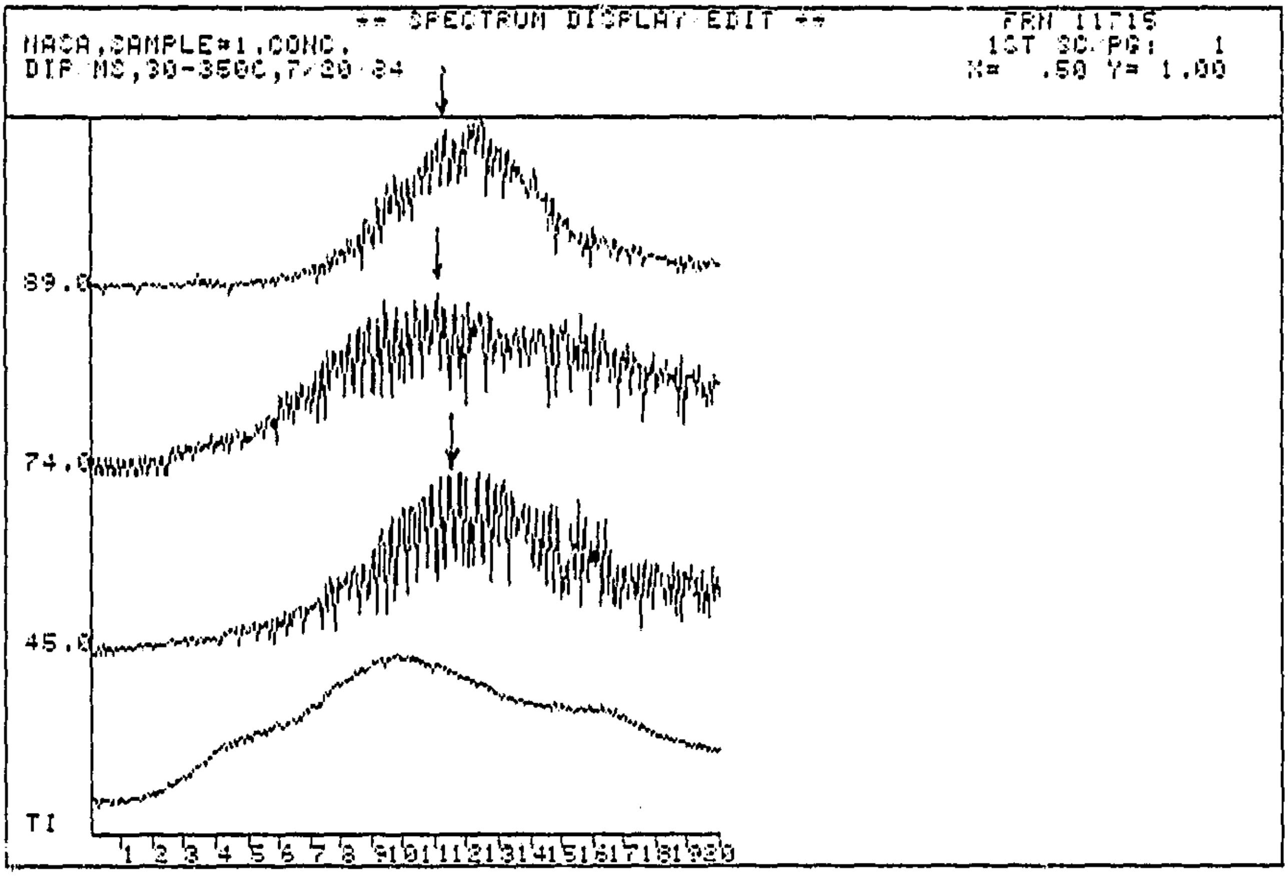
LAST 4: 446.2,100.0 447.2, 34.4 448.1, 5.6 449.1, .9
PAGE 2 Y = 1.00

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FRN 11715
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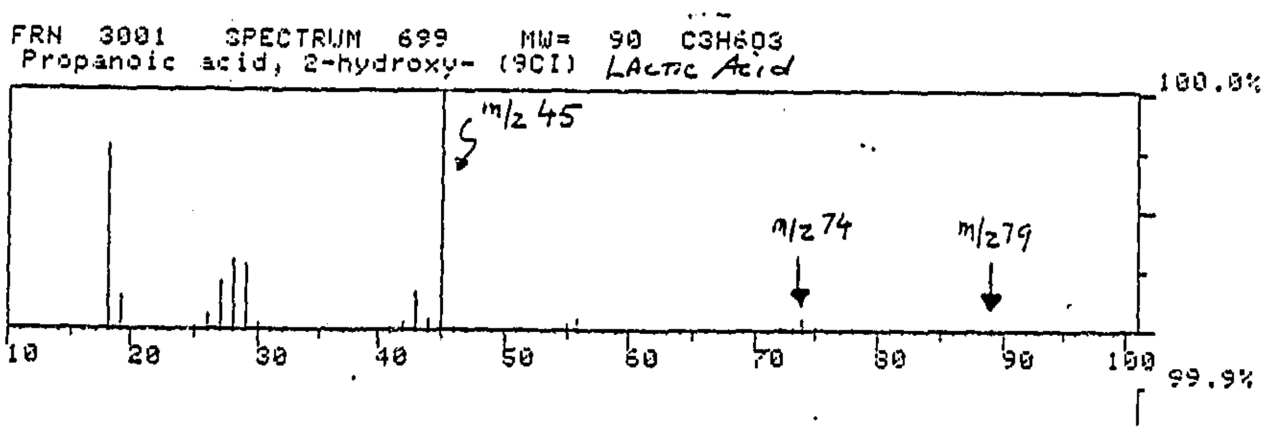
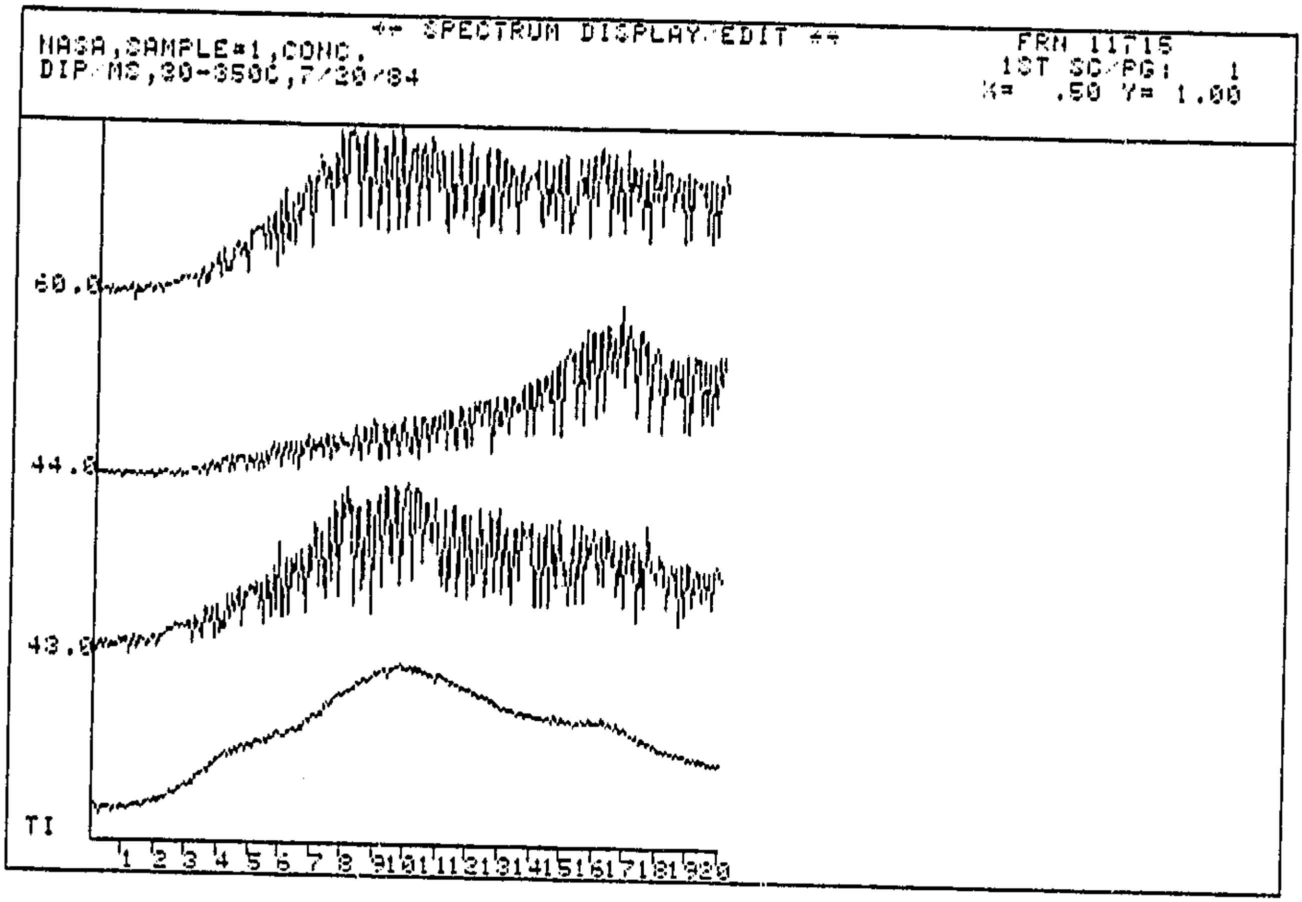
TI
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


FRN 3001 SPECTRUM 699 MW= 90 C3H6O3
Propanoic acid, 2-hydroxy- (9CI) Lactic Acid
m/z 45
m/z 74
m/z 79
100.0%
99.9%
10 20 30 40 50 60 70 80 90 100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FRN 11715
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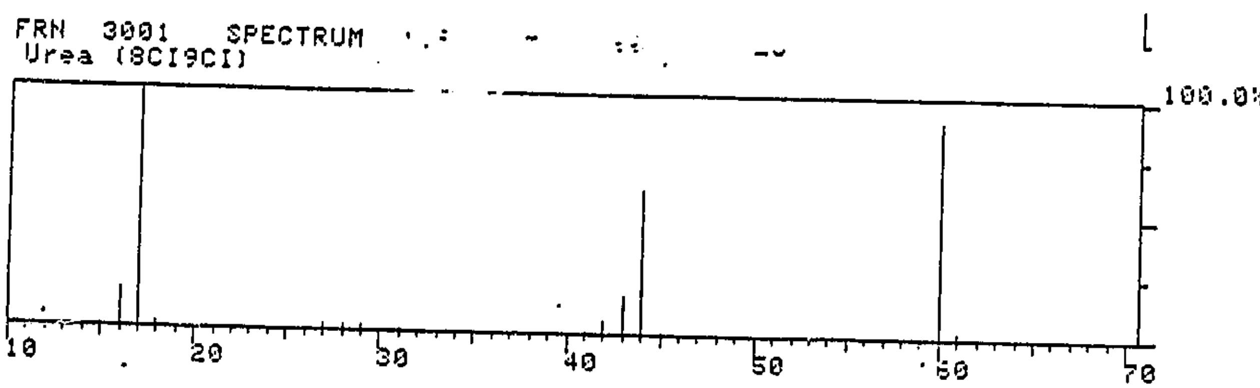
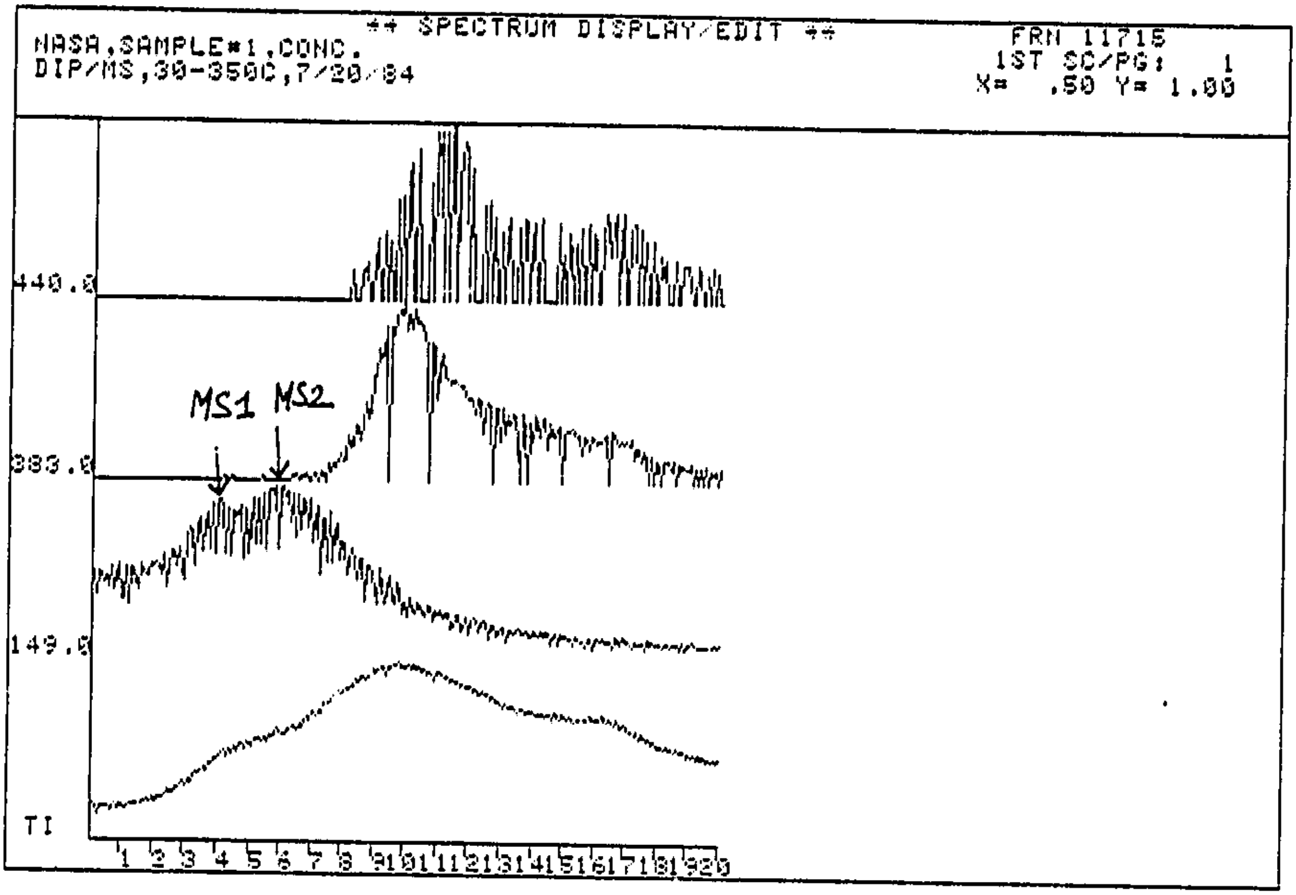
44.0
43.0
TI
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


FRN 3001 SPECTRUM
Urea (8CI9CI)
100.0%
10
20
30
40
50
60
70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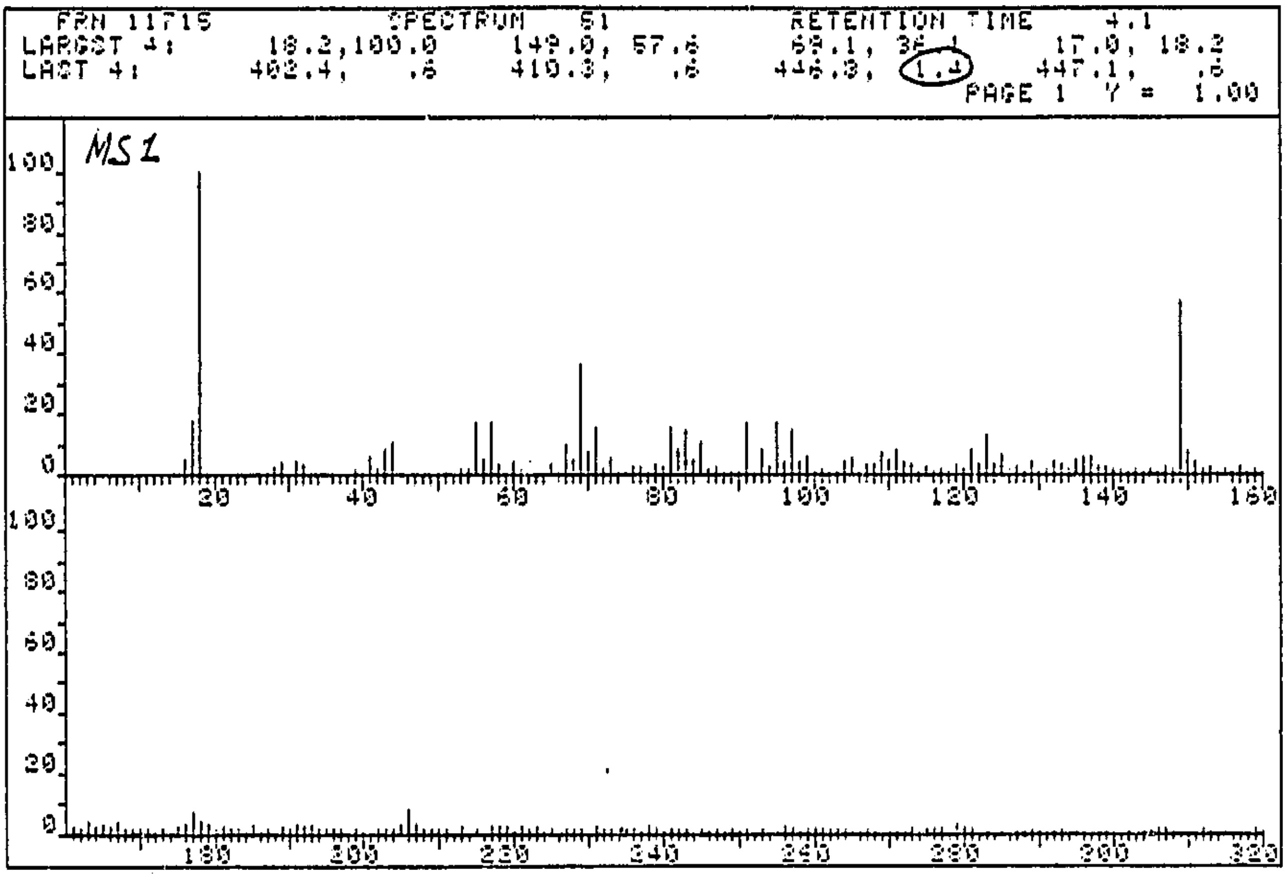
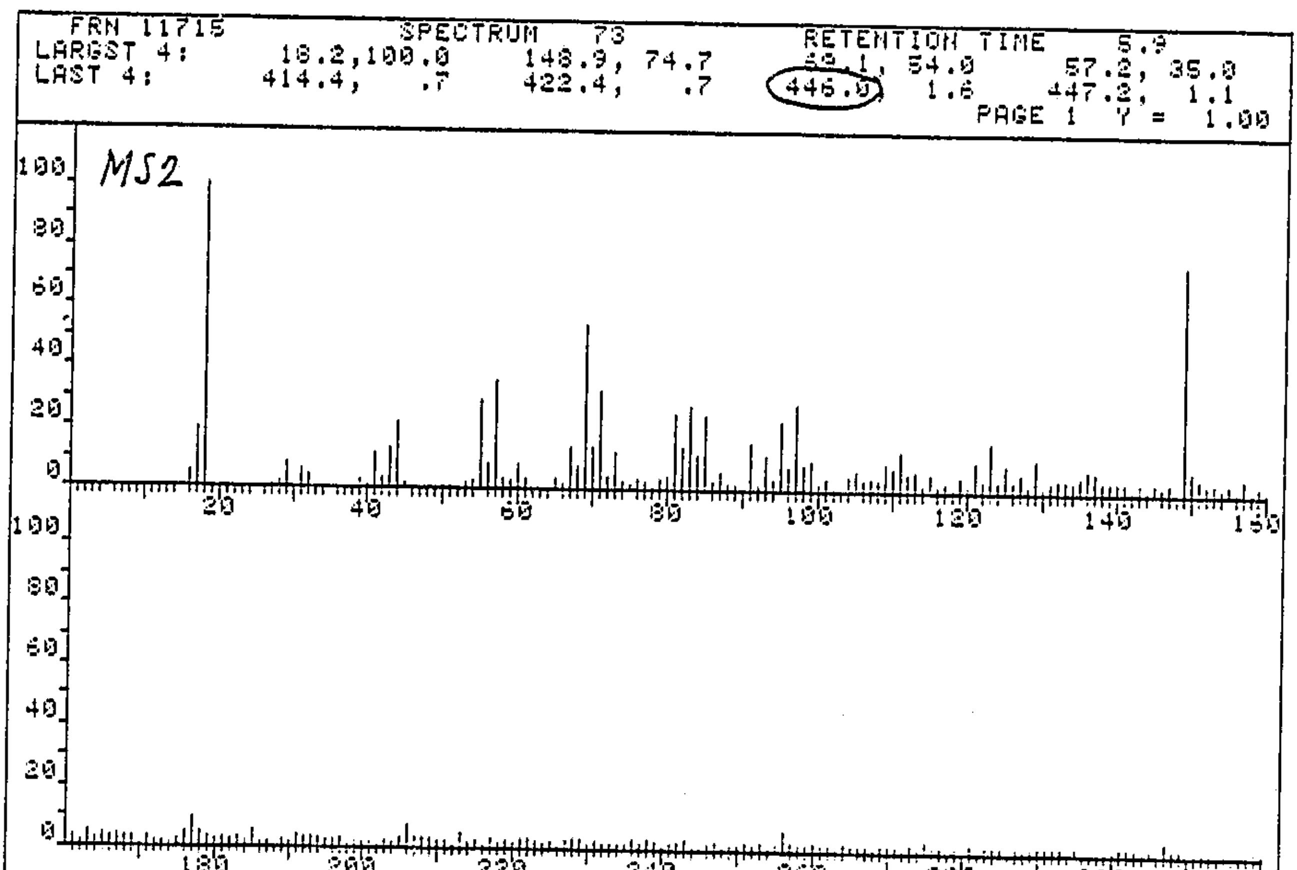
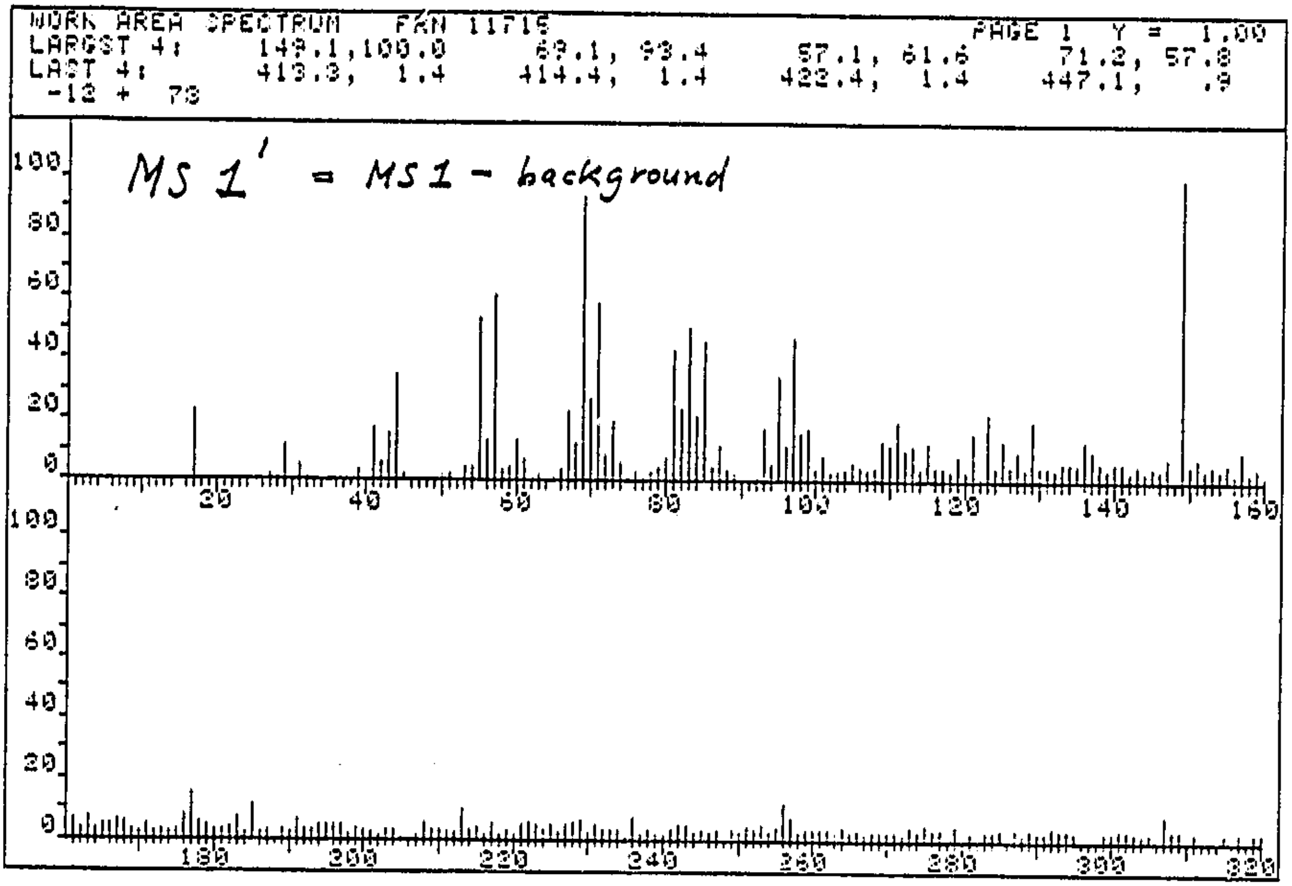
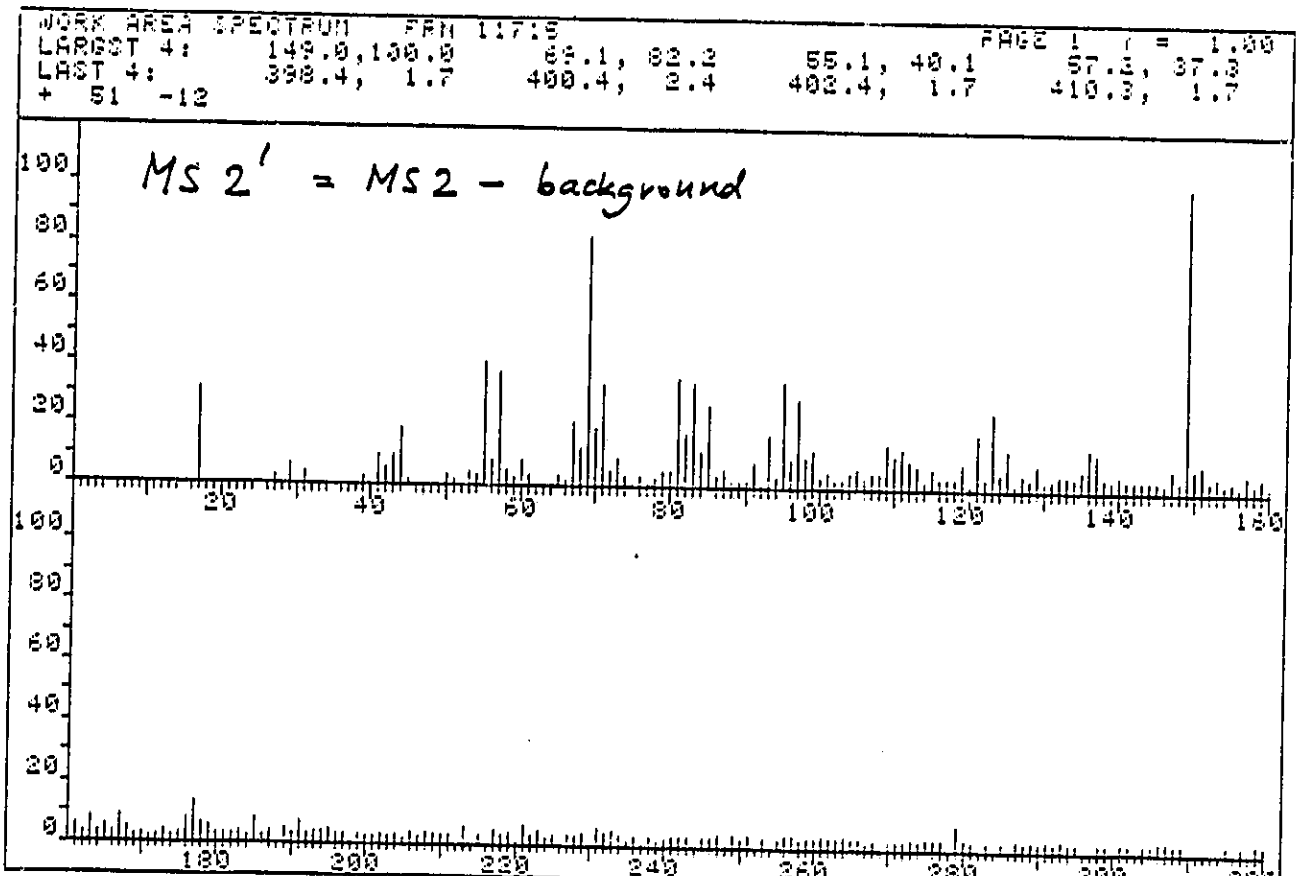
383.0
149.0
TI
MS1
MS2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


FRN 11715 SPECTRUM 51 RETENTION TIME 4.1
LARGST 4: 18.2,100.0 149.0, 57.6 69.1, 36.1 17.0, 18.2
LAST 4: 402.4, .6 410.3, .6 446.3, 1.4 447.1, .6
PAGE 1 Y = 1.00
MS1
100
80
60
40
20
0
20 40 60 80 100 120 140 160
180 200 220 240 260 280 300 320


FRN 11715 SPECTRUM 73 RETENTION TIME 5.9
LARGST 4: 18.2,100.0 148.9, 74.7 69.1, 54.0 57.2, 35.0
LAST 4: 414.4, .7 422.4, .7 446.0, 1.6 447.2, 1.1
PAGE 1 Y = 1.00
MS2
100
80
60
40
20
0
20 40 60 80 100 120 140 160
180 200 220 240 260 280 300 320


WORK AREA SPECTRUM FRN 11715 PAGE 1 Y = 1.00
LARGST 4: 149.1,100.0 69.1, 93.4 57.1, 61.6 71.2, 57.8
LAST 4: 413.3, 1.4 414.4, 1.4 422.4, 1.4 447.1, .9
-12 + 73
MS 1' = MS 1 - background
100
80
60
40
20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320


WORK AREA SPECTRUM FRN 11715 PAGE 1 Y = 1.00
LARGST 4: 149.0,100.0 69.1, 82.2 55.1, 40.1 57.2, 37.3
LAST 4: 398.4, 1.7 400.4, 2.4 402.4, 1.7 410.3, 1.7
+ 51 -12
MS 2' = MS 2 - background
100
80
60
40
20
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320

```
LIBRARY  3000   9442 SPECTRA SEARCHED      10 HIT(S)
MS1'  FRN 11715   -12 +73 332 PEAKS,    319 SIGNIFICANT        MAX I   27.2
.9793 +  Condyfolan-19-carboxylic acid, 2,16-didehydro-, methyl ester
        , 4-oxide (9CI)
        SPEC=  259  LSN= 24829. MW= 340  C20H24N2O3
        FRN = 3017 [NBS  24831.]  CAS #  0040169695   EPA #  0000032095
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  228
         23.1  10   4%    .0   0   0%     .0   0   0%  MULTIPLIER=  .31

.9792    Cyclohexane, (2-decyldodecyl)- (9CI)
        SPEC= 2639  LSN= 27209. MW= 392  C28H56
        FRN = 3017 [NBS  27212.]  CAS #  0006704009   EPA #  0000016846
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  694

         22.6  10  12%    .0   0   0%     .0   0   0%  MULTIPLIER=  .55

.9787 +  4H,5aH,9H-Furo[2,3-b]furo[3',2':2,3]cyclopenta[1,2-c]furan-2
        ,4,7(3H,8H)-trione, 9-(1,1-dimethylethyl)-10,10a-dihydro-8,9
        -dihydroxy-, [5aS-(3aR*,
        SPEC= 7461  LSN= 23953. MW= 326  C15H18O8
        FRN = 3014 [NBS  23955.]  CAS #  0033570046   EPA #  0000028224
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  379
         22.8  10   4%    .0   0   0%     .0   0   0%  MULTIPLIER=  .46

.9785 +  6,10,14-Hexadecatrienoic acid, 3,7,11,15-tetramethyl-, methy
        l ester, [R-(E,E)]- (9CI)
        SPEC= 3194  LSN= 23686. MW= 320  C21H36O2
        FRN = 3014 [NBS  23688.]  CAS #  0036237726   EPA #  0000029260
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  655
         22.6  10  10%    .0   0   0%     .0   0   0%  MULTIPLIER=  .95

.9783 +  1,3-Cyclododecanedione, 2-octyl- (8CI)
        SPEC= 2337  LSN= 22829. MW= 308  C20H36O2
        FRN = 3014 [NBS  22831.]  CAS #  0029550150   EPA #  0000032956
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  446
         22.6  10   4%    .0   0   0%     .0   0   0%  MULTIPLIER=  .35

.9782 +  Nonadecane, 2,6,10,14-tetramethyl- (9CI)
        SPEC= 3429  LSN= 23921. MW= 324  C23H48
        FRN = 3014 [NBS  23923.]  CAS #  0055124806   EPA #  0000015195
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  434
         22.3  10   4%    .0   0   0%     .0   0   0%  MULTIPLIER=  .38

.9781    1,2-Octadecanediol (8CI9CI)
        SPEC=  717  LSN= 21209. MW= 286  C18H38O2
        FRN = 3014 [NBS  21211.]  CAS #  0020294762   EPA #  0000013775
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  639
         22.6  10  20%    .0   0   0%     .0   0   0%  MULTIPLIER=  .72

.9781 +  6,10,14-Hexadecatrien-1-ol, 3,7,11,15-tetramethyl-, [R-(E,E)
        ]- (9CI)
        SPEC= 1193  LSN= 21685. MW= 292  C20H36O
        FRN = 3014 [NBS  21687.]  CAS #  0036237668   EPA #  0000029261
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  655
         22.6  10  12%    .0   0   0%     .0   0   0%  MULTIPLIER= 1.09

.9781 +  Tetracosane (8CI9CI)
        SPEC=  196  LSN= 24756. MW= 338  C24H50
        FRN = 3017 [NBS  24758.]  CAS #  0000646311   EPA #  0000015595
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
         22.0  10  13%    .0   0   0%     .0   0   0%  MULTIPLIER=  .98

.9780    Hexadecane, 1-iodo- (8CI9CI)
        SPEC=  841  LSN= 25411. MW= 352  C16H33I
        FRN = 3017 [NBS  25414.]  CAS #  0000544774   EPA #  0000015979
        MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  655
         21.8  10  11%    .0   0   0%     .0   0   0%  MULTIPLIER=  .73
```

```
FRN 11715  +  51  -12  -12 +  51
MS2'   312 PEAKS,   306 SIGNIFICANT      MAX K   27.3
```



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LIBRARY  3000   7707 SPECTRA SEARCHED,    10 HIT(S)

.9802 +  4H-1-Benzopyran-4-one, 2-(3,4-dimethoxyphenyl)-3,5-dihydroxy
         -7-methoxy- (9CI)
       SPEC=  440  LSN= 25010. MW= 344  C18H1607
       FRN = 3017 [NBS  25013.]  CAS #  0006068800   EPA #  0000043865
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=    0
        24.3  10   4%    .0   0   0%    .0   0   0%  MULTIPLIER=  .32

.9793 +  Cholestan-3-ol, 2-methylene-, (3.beta.,5.alpha.)- (9CI)
       SPEC= 2968  LSN= 27538. MW= 400  C28H480
       FRN = 3017 [NBS  27541.]  CAS #  0022599968   EPA #  0000048741
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  577
        22.7  10  14%    .0   0   0%    .0   0   0%  MULTIPLIER=  .42

.9786 +  6,10,14-Hexadecatrienoic acid, 3,7,11,15-tetramethyl-, methy
         l ester, [R-(E,E)]- (9CI)
       SPEC= 3194  LSN= 23686. MW= 320  C21H3602
       FRN = 3014 [NBS  23688.]  CAS #  0036237726   EPA #  0000029260
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  655
        22.9  10  11%    .0   0   0%    .0   0   0%  MULTIPLIER=  .77

.9785 +  8,12-Tetradecadienoic acid, 5-ethenyl-3,5,9,13-tetramethyl-,
         methyl ester (9CI)
       SPEC= 3195  LSN= 23687. MW= 320  C21H3602
       FRN = 3014 [NBS  23689.]  CAS #  0036237737   EPA #  0000029262
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  655
        22.7  10  11%    .0   0   0%    .0   0   0%  MULTIPLIER=  .47

.9784 +  Hexanoic acid, 6,6'-diselenodi- (8CI)
       SPEC= 2517  LSN= 27087. MW= 390  C12H2204Se2
       FRN = 3017 [NBS  27090.]  CAS #  0022676353   EPA #  0000032749
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  626
        21.8   9   8%    .0   0   0%    .0   0   0%  MULTIPLIER=  .41

.9781 +  6,10,14-Hexadecatrien-1-ol, 3,7,11,15-tetramethyl-, [R-(E,E)
         ]- (9CI)
       SPEC= 1193  LSN= 21685. MW= 292  C20H360
       FRN = 3014 [NBS  21687.]  CAS #  0036237668   EPA #  0000029261
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  655
        22.7  10  14%    .0   0   0%    .0   0   0%  MULTIPLIER= 1.02

.9779    Pentalene, octahydro-1-(2-octyldecyl)- (9CI)
       SPEC= 1405  LSN= 25975. MW= 362  C26H50
       FRN = 3017 [NBS  25978.]  CAS #  0055401655   EPA #  0000023513
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  729
        21.6  10  15%    .0   0   0%    .0   0   0%  MULTIPLIER=  .40

.9773    Decane, 4,5-dibromo-, (R*,R*)- (9CI)
       SPEC= 1541  LSN= 22033. MW= 298  C10H20Br2
       FRN = 3014 [NBS  22035.]  CAS #  0061141706   EPA #  0000045333
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=  728
        21.8  10  15%    .0   0   0%    .0   0   0%  MULTIPLIER=  .81

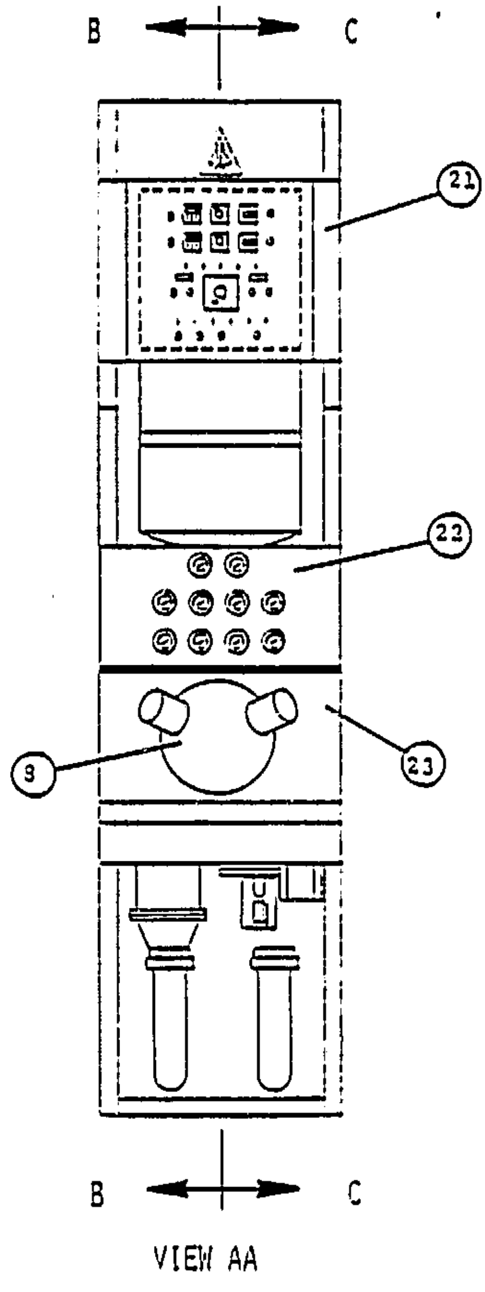
.9773    1-Naphthalenepentanoic acid, 6-(acetyloxy)decahydro-2-hydrox
         y-.beta.,2,5,5,8a-pentamethyl-, methyl ester, [1S-[1.alpha.(
         S*),2.beta.,4a.beta.,6.a
       SPEC= 2755  LSN= 27325. MW= 396  C23H4005
       FRN = 3017 [NBS  27328.]  CAS #  0052567621   EPA #  0000031496
       MATCHING PEAKS   CONTAMINATED   MISSING PEAKS  QUAL INDEX=   60
        20.7   9   4%    .0   0   0%    .0   0   0%  MULTIPLIER=  .33
```

APPENDIX

SUMMARY LIST 9

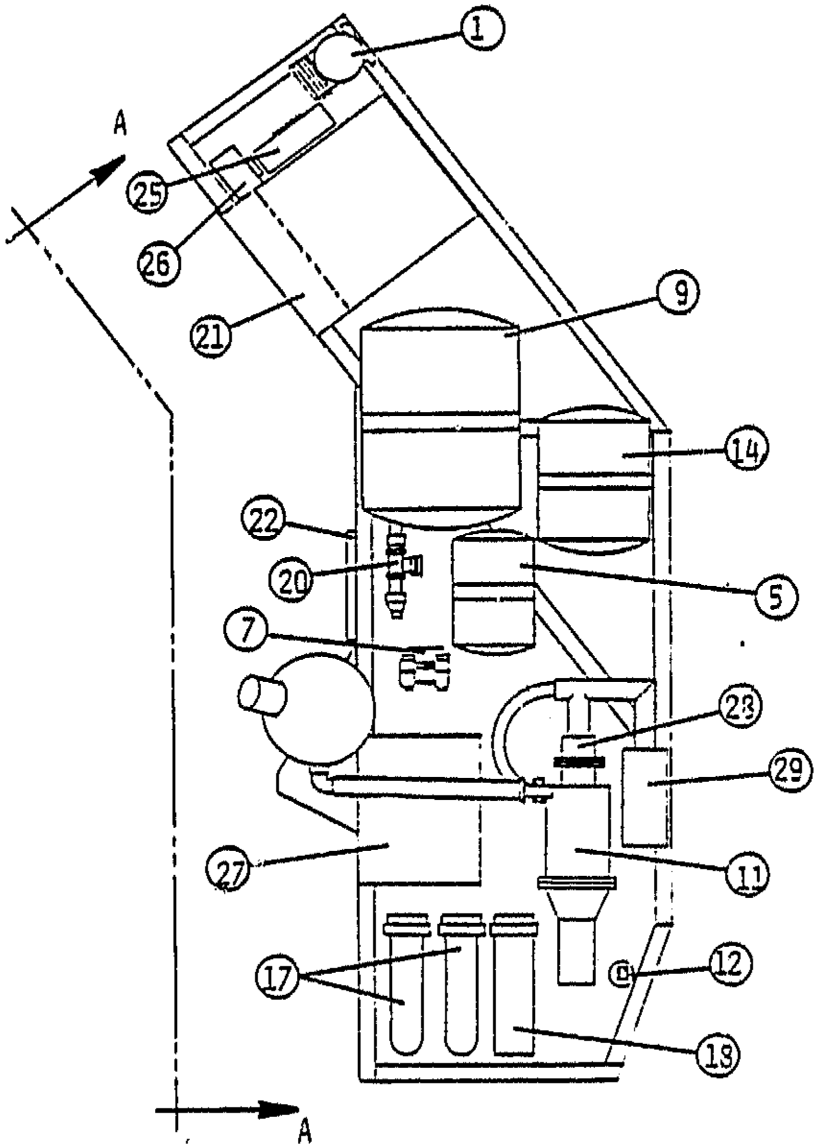
PARTS LIST & FIGURES

Parts List	Figure	Description
1	7	Prototype Major Components Front View
1	7A	Prototype Right Side View
1	8	Prototype Left Side View
2	9	Control Components
2	9A	SUHCF Wiring Diagram
3	10	Air Supply System
4	11	Soap and $FeCl_3$ System
5	12	Water Supply System
6	13	Mixing System
7	14	Waste Water System
8	15	Filter System
	16	Wiring Diagram
	17	Wiring Diagram
	18	Mixing Tank
	19	Waste Tank
	20	Prototype Frame
	21	Demonstration Hand Washing PWWWRS/SUHCF Prototype
	22	PWWWRS/SUHCF Recharging System
	23	Rear View PWWWRS/SUHCF Sampling Valves at Top Mixing Tank and Deareator
	24	CP 162 Chassis
	25	Wiring Diagram



PWWWRS/SUHCF MAJOR COMPONENTS
FRONT VIEW

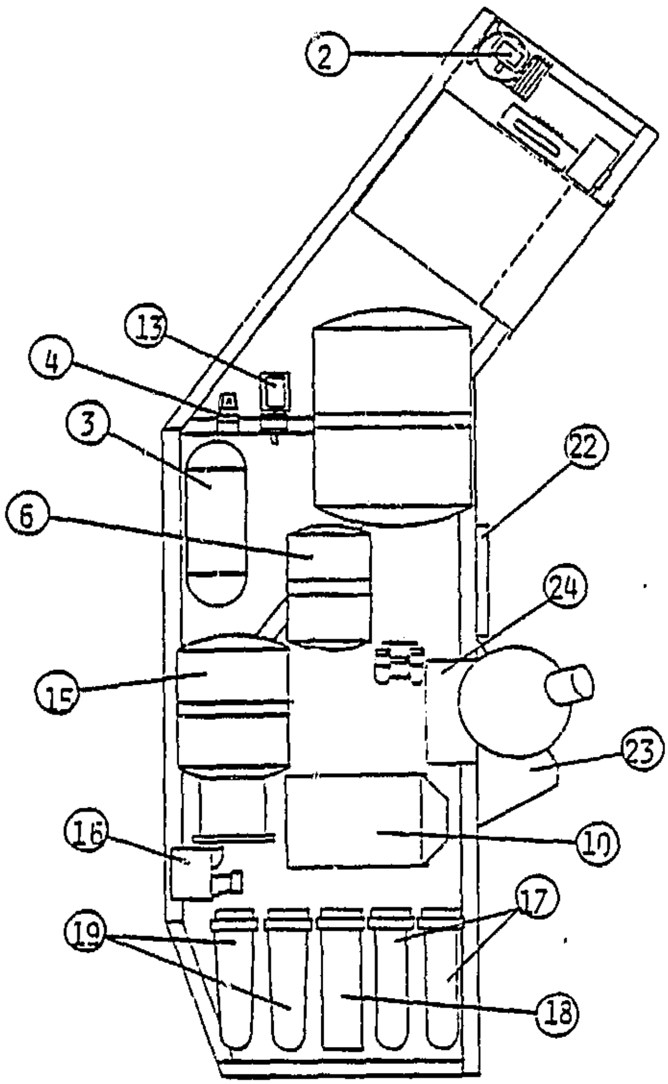
FIGURE 7



VIEW BB

PWWWRS/SUHCF
RIGHT SIDE VIEW

FIGURE 7A



VIEW CC

PWWWRS/SUHCF
LEFT SIDE VIEW

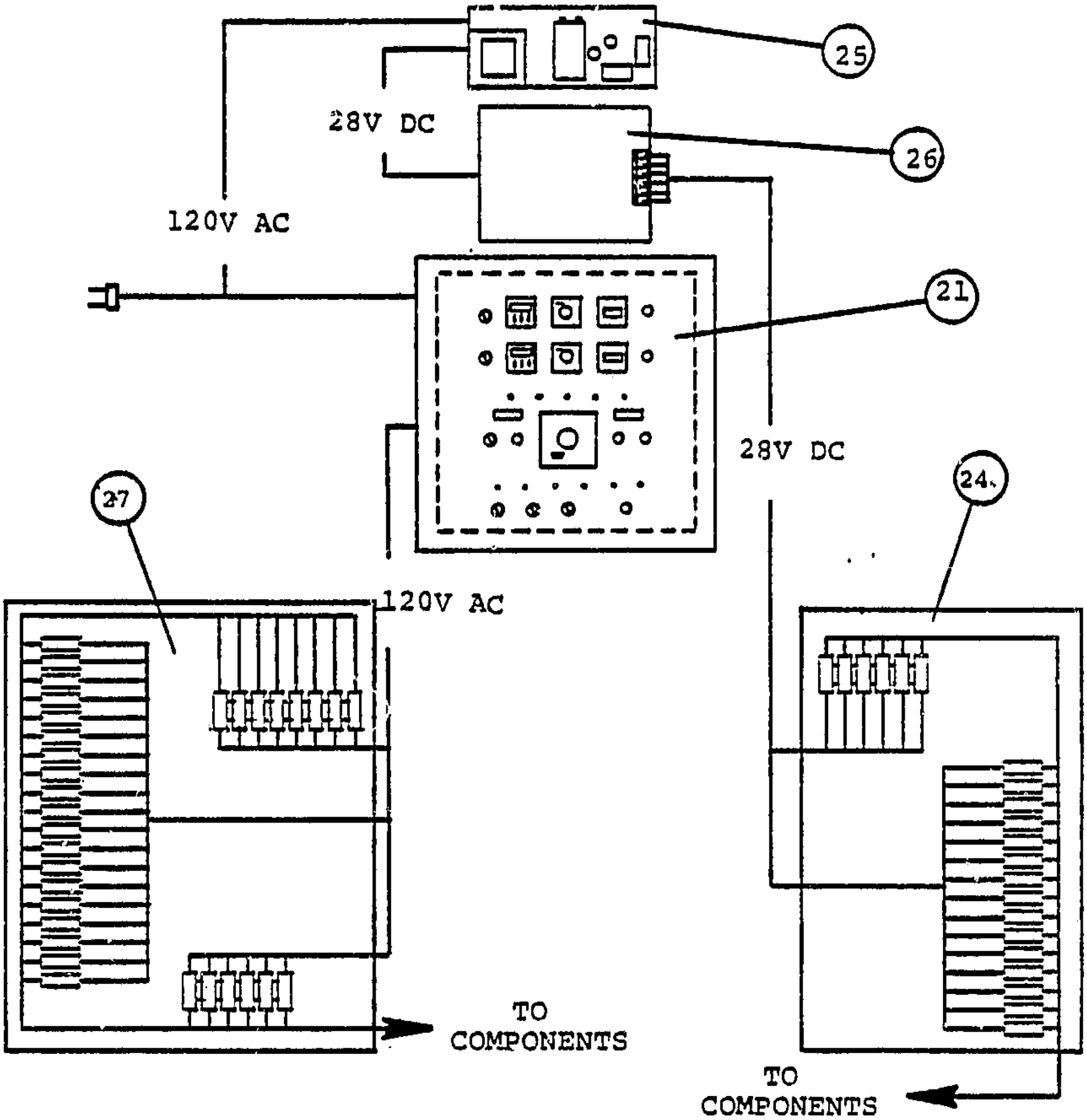
FIGURE 8

Number	Part
1	Air Compressor
2	Pressure Switch
3	Air Storage Tank
4	Air Regulator
5	$FeCl_3$ Tank (2 gal. capacity)
6	Soap Tank (2 gal. capacity)
7	Dispense Valve
8	Hand Washing Enclosure
9	Supply Tank
10	SUHCF Water Heater
11	Liquid Gas Separator
12	Sump Pump
13	Pressure Switch
14	Waste Tank
15	Mixing Tank
16	Motor Actuated Ball Valve
17	String Filters
18	Ion Exchangers
19	Charcoal Filters
20	Conductivity Sensor
21	PWWWRS Control Panel
22	Pressure Gage Panel
23	SUHCF Control Panel
24	SUHCF Valve Plate & Terminal Board
25	SUHCF Control Plan
26	SUHCF Power Supply
27	PWWWRS Valve Plate & Terminal Board
28	SUHCF Air Blow
29	SUHCF Charcoal Filter

PARTS LIST - MAJOR COMPONENTS

FOR FIGURES 7, 7A, 8

LIST 1



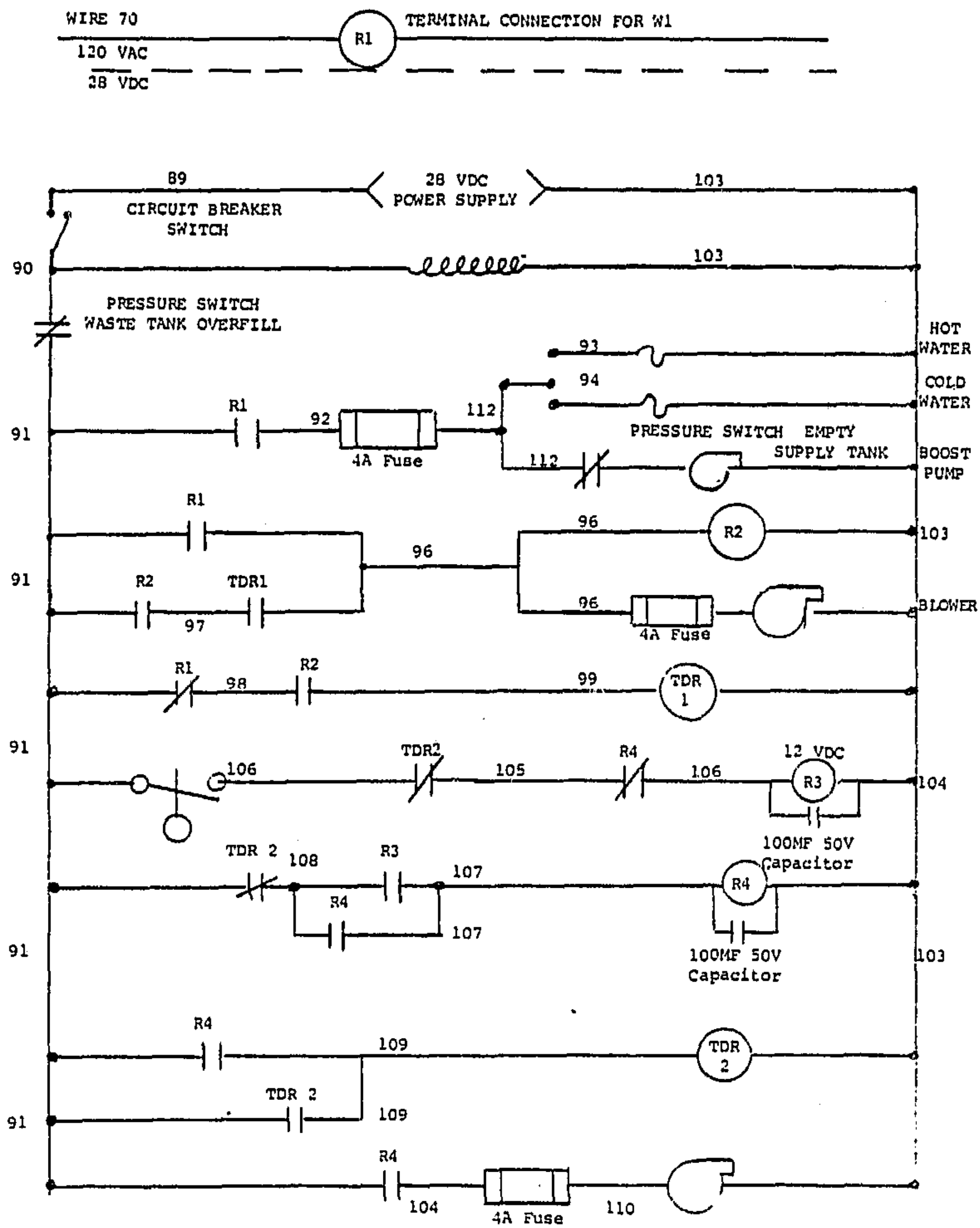
CONTROL COMPONENTS

FIGURE 9

PART NO.	DESCRIPTION	MATERIAL	QTY.
21	PWWWRS Control Panel	Aluminum	1
25	SUHCF Power Supply	Aluminum	1
26	SUHCF Control Box Refer to 28	Aluminum	1
27	PWWWRS Valve Terminal Board	Refer to 28	1
24	SUHCF Valve Terminal Board	P.E. Clad	1
	THFFN 16 Gage Wire	Copper	A/R
25	Power Supply-Power One Model CP162		
26	SUHCF Schematic Dwg SK8ZG51 Code 04236 Size D NASA Cont. NAS 9-15880	Superceded by Item 28	
28	Wiring Diagram Figure 9A	Revised SUHCF)	

PARTS LIST CONTROL COMPONENTS
FOR FIGURE 9

LIST 2



SUHCF WIRING DIAGRAM
REVISION-1
INTEGRATED WITH PWWWRS

FIGURE 9A

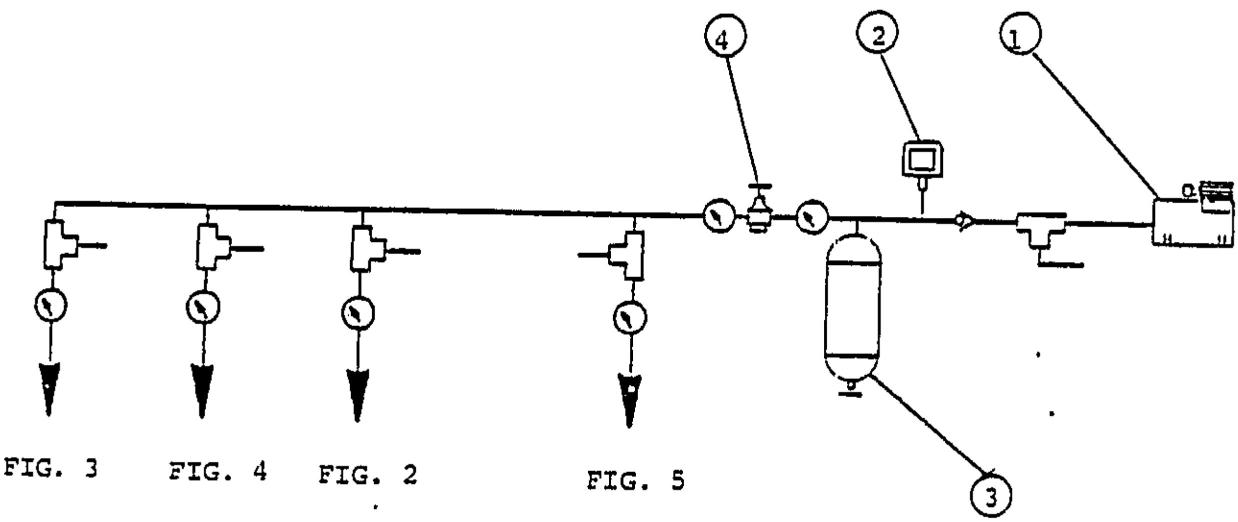


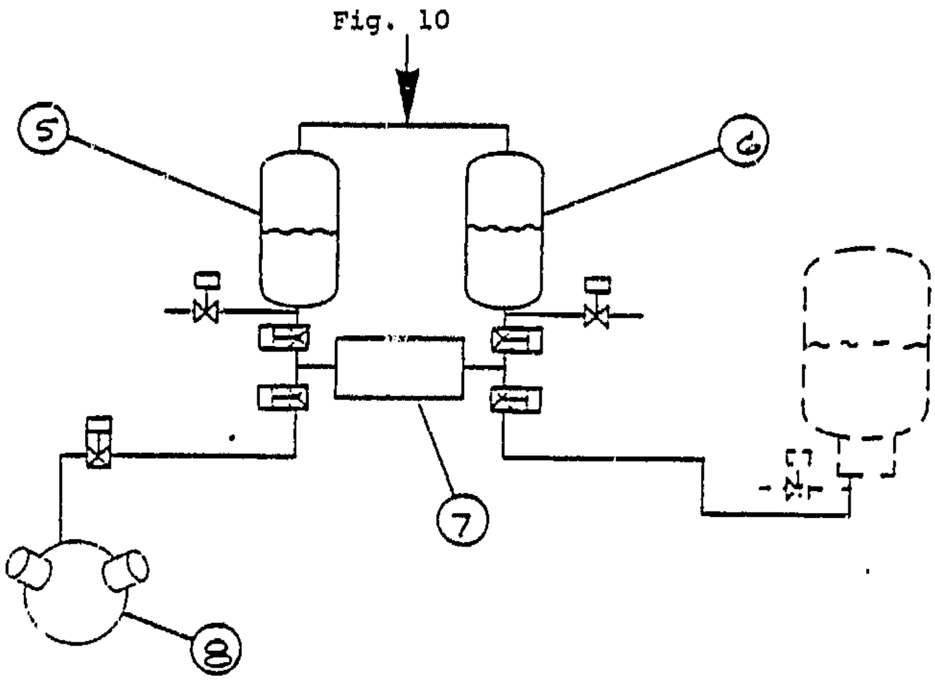
FIG. 3 FIG. 4 FIG. 2 FIG. 5

AIR SUPPLY SYSTEM

FIGURE 10

PART NO.	DESCRIPTION	MATERIAL	QTY.
1	Thomas Compressor 607CE40		1
	6-32 Soc. HD. Cap Screws	Steel	4
	Check Valve 1/4 NPT Parker	Stainless Steel	1
	6-4 CBZ Fitting Parker	Stainless Steel	2
	4-4 FHC Parker	Stainless Steel	1
	Skinner BB 3-Way Valve	Stainless Steel	5
	Valve Manifold	Brass	1
	Close Nipple 1/4" NPT	Stainless Steel	3
	Coupling 1/4" NPT	Stainless Steel	1
2	Square "D" Pumptroll Pressure Switch No. FHG-12		
	Mounting Bracket	Aluminum	1
	Cable Set, Screw Connector	Aluminum	2
	1/4-20 Soc. HD. Cap Screws	Steel	2
	4-4-4 Ft. Fitting Parker	Stainless Steel	2
3	2-Gallon Air Storage Tank ITT Numative - Piggy Back Tank	Steel	1
	Modified Unistrut Pipe Strap 2062-50D	Steel	1
	Petcock 1/8 NPT	Brass	1
	Pressure Regulator Watts Model #R-364-02	Brass	1
	0-30 Psi Helicoid #3505-1 Gage	Brass	6
	6-4 FBZ Fitting Parker	Stainless Steel	5
	6-2 FBZ Fitting Parker	Stainless Steel	9
	6-2 DBZ Fitting Parker	Stainless Steel	6
	6-2 CBZ Fitting Parker	Stainless Steel	1
	6-6-4 RBZ Fitting Parker	Stainless Steel	1
	6-6-6 JBZ Fitting Parker	Stainless Steel	7
	6-2 TEHZBZ Fitting Parker	Stainless Steel	8
	Gould Imperial Eastman 66-P-3/8 Tubing	PE	A/R

PARTS LIST
AIR SUPPLY SYSTEM FIGURE 10
LIST 3



SOAP AND $FeCl_3$ SYSTEM

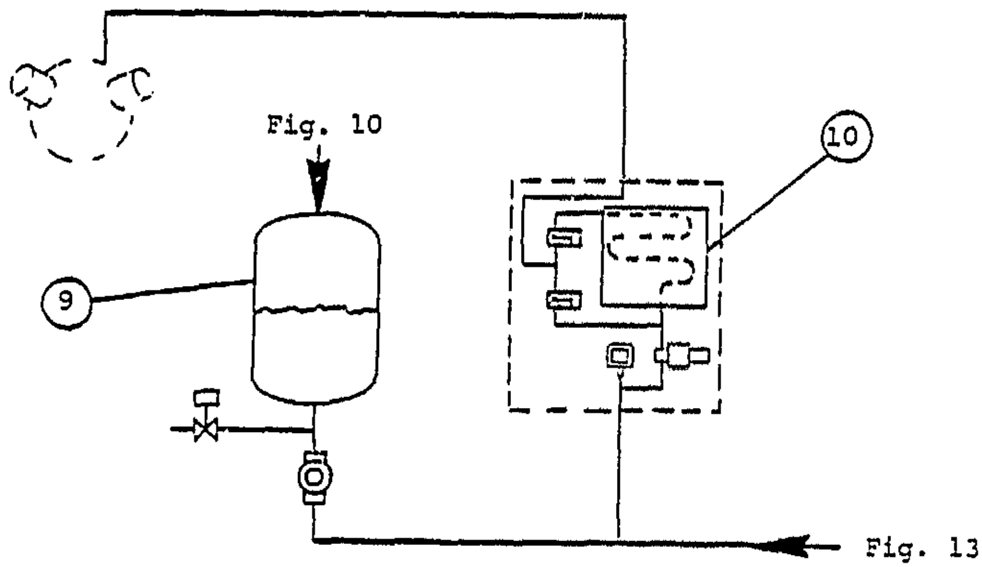
FIGURE 11

ORIGINAL PAGE IS
OF POOR QUALITY

PART NO.	DESCRIPTION	MATERIAL	QTY.
5	Well-X-Trol 101 STD (2 gal. cap.)	Steel	1
	1/4 to 1/4 NPT Coupling	Stainless Steel	1
	Modified SUHCF Tank Strap	Aluminum	2
	4-4-4 Ft. Fitting Parker	Stainless Steel	1
	6-4 CBZ Fitting Parker	Stainless Steel	1
	4-4 FBZ Fitting Parker	Stainless Steel	1
	5/16 - 32 to 1/4 NPT Coupling	Stainless Steel	2
6	FeCl Whitey SS 4254 Ball Valve	Stainless Steel	1
	Well-X-Trol 101 Special (2 gal. cap.)	Stainless Steel Bushing	1
	Modified SUHCF Tank Strap	Aluminum	1
	Reducer Bushing 3/4-1/4 NPT	PVC	1
	10-24 Soc. Hd. Cap Screw	Steel	10
	Chem Cock Ball Valve	PVC	1
	P6MC4 Fitting Parker	PP	3
7	Dispensing Valve	Acrylic	1
	Dispensing Valve Bracket	Aluminum	1
	Female Pipe Tee 1/4 NPT	PVC	1
	Close Nipple 1/4 NPT	PVC	7
	6-4 FBZ Fitting Parker	Stainless Steel	2
	Hacon Solinoid Valves WNE	Teflon	4
	Skinner B2 2-Way Valve	Stainless Steel	1
8	SUHCF Hand Washing Enclosure	Acrylic	1
	SUHCF Hand Washing Enclosure Panel	Steel	1
	6-4 HBZ Fitting Parker	Stainless Steel	1
	4-4 CBZ Fitting Parker	Stainless Steel	1
	Gould Imperial Eastman 66-P-3/8 Tubing	PE	A/R

PARTS LIST
FOR SOAP AND $FeCl_3$ SYSTEM FIGURE 11

LIST 4



MICROBIAL CHECK VALVE GFE 80508

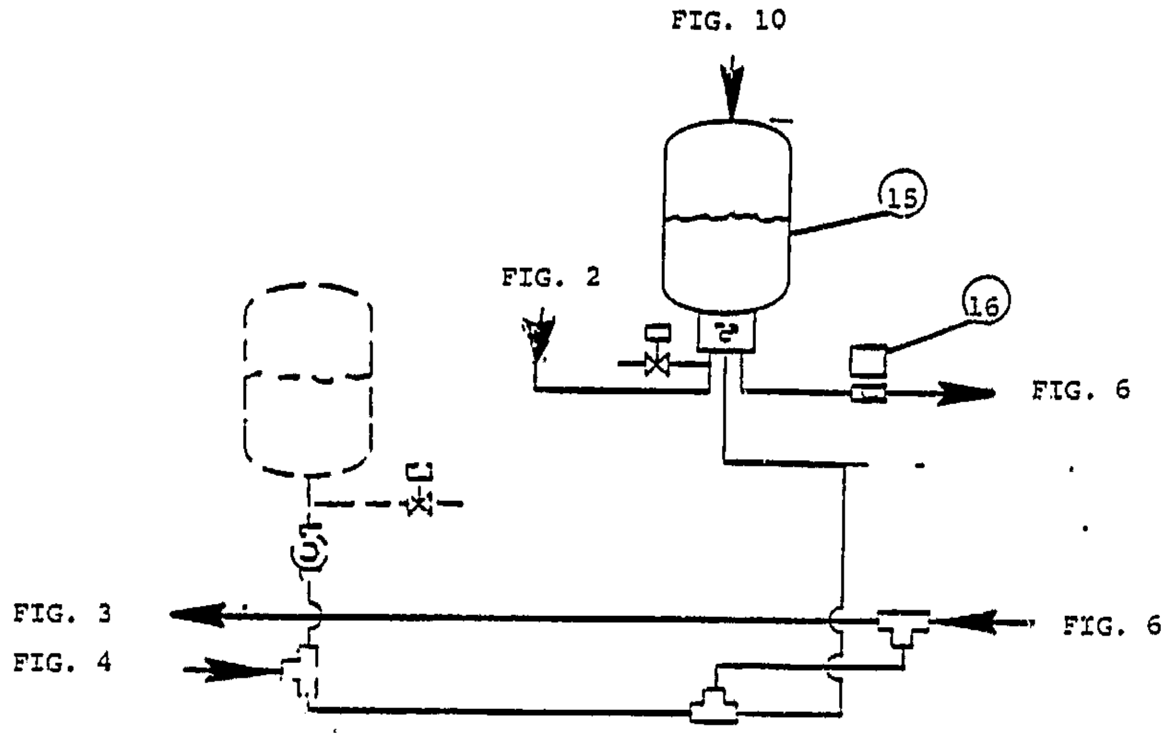
WATER SUPPLY SYSTEM

FIGURE 12

PART NO.	DESCRIPTION	MATERIAL	QTY.
9	[illegible]	(8.6 gal. capacity)	1
	SUHCF Tank Strap	Aluminum	1
	SUHCF Flow Indicator	Brass	1
	6-4 CBZ Fitting Parker	Stainless Steel	1
	16-6 RB Fitting Parker	Stainless Steel	1
	5/16-32 to 1/4 NPT Coupling	Stainless Steel	1
	6-4 RB Fitting Parker	Stainless Steel	1
	Close Nipple 1/4 NPT	Stainless Steel	1
	4-4-4 Ft Fitting Parker	Stainless Steel	1
	6-6-6 JBZ Fitting Parker	Stainless Steel	1
	6-4 FBZ Fitting Parker	Stainless Steel	1
	4-4 FBZ Fitting Parker	Stainless Steel	1
	Whitey SS42J4 Ball Valve	Stainless Steel	1
10	SUHCF Water [illegible]ater		1
	Micro Pump #12A-31-316	Stainless Steel	1
	1/4-20 SOC Hd. Cap Screw	Steel	3
	SUHCF Pressure Switch		1
	Swaglok Pressure Release Valve	Stainless Steel	1
	4-4 CBZ Fitting Parker	Stainless Steel	1
	4-4-4 JBZ Fitting Parker	Stainless Steel	4
	4-4 CBZ Fitting Parker	Stainless Steel	7
	6-4 HBZ Fitting Parker	Stainless Steel	1
	Skinner BZ 2-Way Valve	Stainless Steel	2
	1/4" OD Tubing x .035 Wall	Stainless Steel	A/R
	3/8 OD Tubing x .035 Wall	Stainless Steel	A/R

PARTS LIST
WATER SUPPLY SYSTEM FOR FIGURE 12

LIST 5

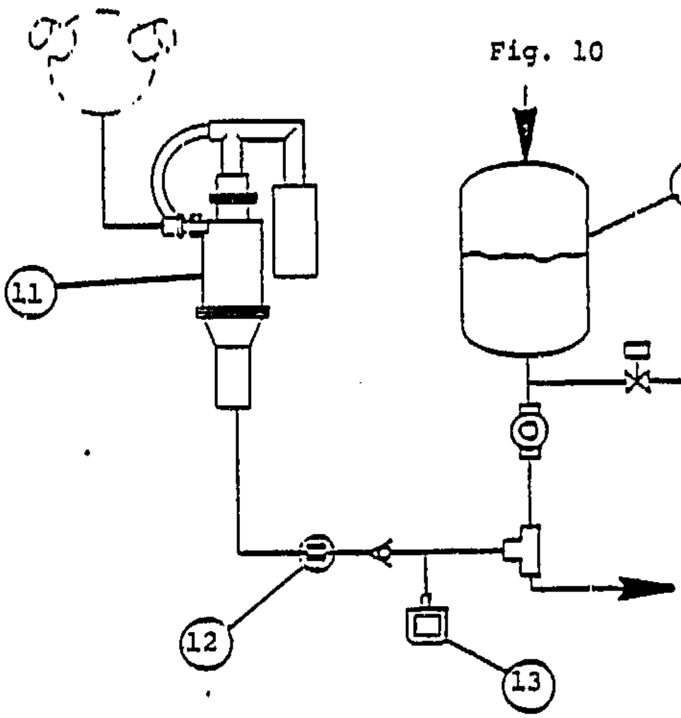


MIXING SYSTEM
FIGURE 13

PART NO.	DESCRIPTION	MATERIAL	QTY.
15	Figure 18		
	Modified Unistrut Pipe Strap P2070-81	Steel	1
	Jet Agitator - Spraying Systems Co. No. 3290-SC	Brass	1
	Gasket	Cork	1
	Skinner B.3 3-Way Valve	Stainless Steel	2
	5/16-32 to 1/4 NPT Coupling	Stainless Steel	1
	6-2 CBZ Fitting Parker	Stainless Steel	6
	6-4 CBZ Fitting Parker	Stainless Steel	2
	12-8 RB Fitting Parker	Stainless Steel	1
	8-4 RB Fitting Parker	Stainless Steel	1
	8-8 MHN-2" Fitting Parker	Stainless Steel	1
	8-8 THC Fitting Parker	Stainless Steel	1
	8-8 MHN Fitting Parker	Stainless Steel	1
	Close Nipple 1/4 NPT	PVC	3
	Elbow 1/4 NPT	PVC	1
	Chem Cock Ball Valve	PVC	1
	P6FC4 Fitting Parker	PP	1
16	Jenkins Motor Actuated Ball Valve #203	Stainless Steel	1
	Gould Imperial Eastman 66-P-3/8	PE	A/R

PARTS LIST
MIXING SYSTEM FIGURE 13

LIST 6



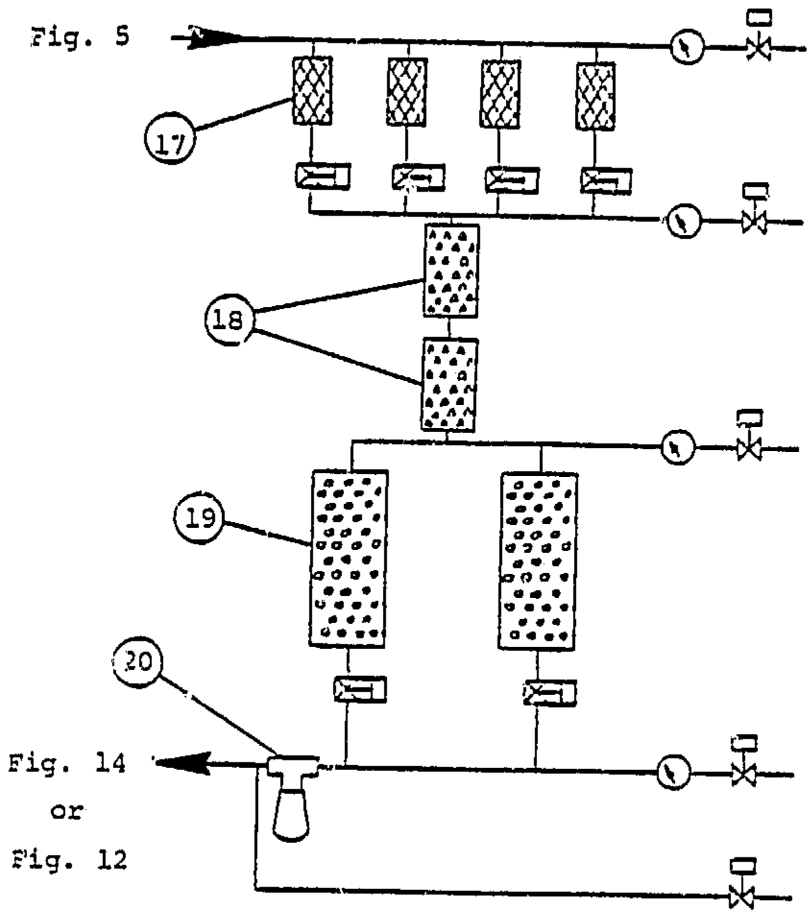
WASTE WATER SYSTEM

FIGURE 14

PART NO.	DESCRIPTION	MATERIAL	QTY.
11	SUHCF Liquid Gas Separator	Acrylic	1
	Liquid Level Control - SUHCF	NAS 9-15880	1
	SUHCF Charcoal Filter	Aluminum	1
	3" Hose Clamp	Steel	6
	SUHCF Air Blower	Steel	1
	SUHCF Mounting Straps	Aluminum	2
12	Micro Pump Magnetic Drive #V20-306-0000	Aluminum	1
	Micro Pump Bracket	Aluminum	1
	1/4-20 SOC. HD. Cap Screw	Steel	4
	Swagelok Check Valve	Stainless Steel	1
	4-4 FBZ Fitting Parker	Stainless Steel	3
	4-4 CBZ Fitting Parker	Stainless Steel	2
	6-4 HBZ Fitting Parker	Stainless Steel	1
13	Square "D" Pressure Switch #9012		1
14	Well-X-Trol 102 Full Volume	(4.4 gal. capacity)	1
	Modified Unistrut Pipe Strap #920708	Steel	1
	SUHCF Flow Indicator	Brass	1
	Skinner BB 3-Way Valve	Stainless Steel	1
	6-4 FBZ Fitting Parker	Stainless Steel	2
	6-4 CBZ Fitting Parker	Stainless Steel	1
	6-2 CBZ Fitting Parker	Stainless Steel	3
	6-6 EBZ Fitting Parker	Stainless Steel	1
	6-6-6 JBZ Fitting Parker	Stainless Steel	1
	5/16-32 to 1/4 NPT Coupling	Stainless Steel	1
	12-4 RB Fitting Parker	Stainless Steel	1
	Close Nipple 1/4 NPT	Stainless Steel	2
	6-6-6 Ft Fitting Parker	Stainless Steel	1
	Whitey SS4254 Ball Valve	Stainless Steel	1
	Gould Imperial Eastman 66-P-3/8 Tubing	PE	A/R

PARTS LIST
WASTE WATER SYSTEM FIGURE 14

LIST 7



FILTER SYSTEM

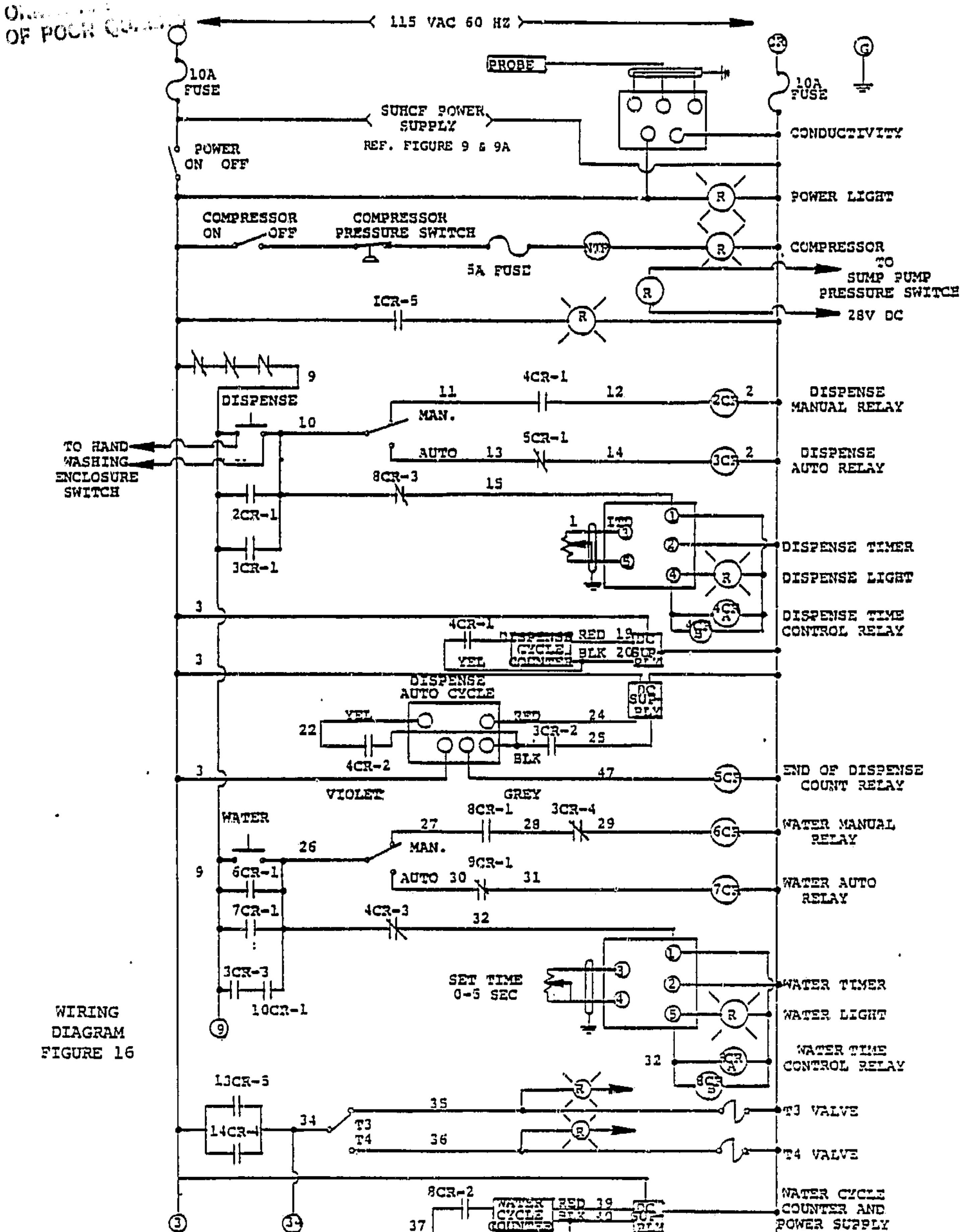
FIGURE 15

OF POOR QUALITY

PART NO.	DESCRIPTION	MATERIAL	QTY.
17	AMF Cuno Filter Housing #CT 101 3/4" NPT	4 4152-01 Stainless Steel & Brass	
	AMF String Filter Cartridge Micro-Wynd II	DPPPY	4
18	AMF Cuno Filter Housing #1M1 3/4" NPT	Plastic Acrylic/Styrene	2
	AMF Activated Carbon Cartridge	Cat. No. 46285-01	2
19	AMF Cuno Penfield Water Conditioner Housing		2
	AMF Ion Exchange Resin Ref: Model SM04010 Demineralizer		2 Bags
	Filter Manifold	Aluminum	1
	Shaw-Walker Draw Slide	Steel	1 Pair
	1/4-20 Soc. Hd. Cap Screw	Steel	34
	6-2 CBZ Fitting Parker	Stainless Steel	16
	12-4 RB Fitting Parker	Stainless Steel	16
	6-6-6 JBZ Fitting Parker	Stainless Steel	15
	Skinner B2 2-Way Valve	Stainless Steel	6
	6-2 FBZ Fitting Parker	Stainless Steel	9
	6-2 CBZ Fitting Parker	Stainless Steel	4
	6-2 T2H2BZ Fitting Parker	Stainless Steel	4
	Valve Manifold	Brass	1
	Parker Vall Valve #172F	Stainless Steel	5
	0-30 Psi Heliloid Gages #3505-1	Brass	4
20	Leeds & Northrup Conductivity Cell Catalog 7086-1-7-000	Plastic	1
	Female Pipe Tee 3/4 NPT	Brass	1
	2" Nipple 3/4 NPT	Brass	1
	12-4 RB Fitting Parker	Stainless Steel	1
	Coupling 3/4 to 1/2 NPT	Brass	1
	Reducer Bushing 1/2 to 1/4 NPT	PP	1
	6-4 CBZ Fitting Parker	Stainless Steel	1
	6-6-4 RBZ Fitting Parker	Stainless Steel	1
	6-4 DBZ Fitting Parker	Stainless Steel	4

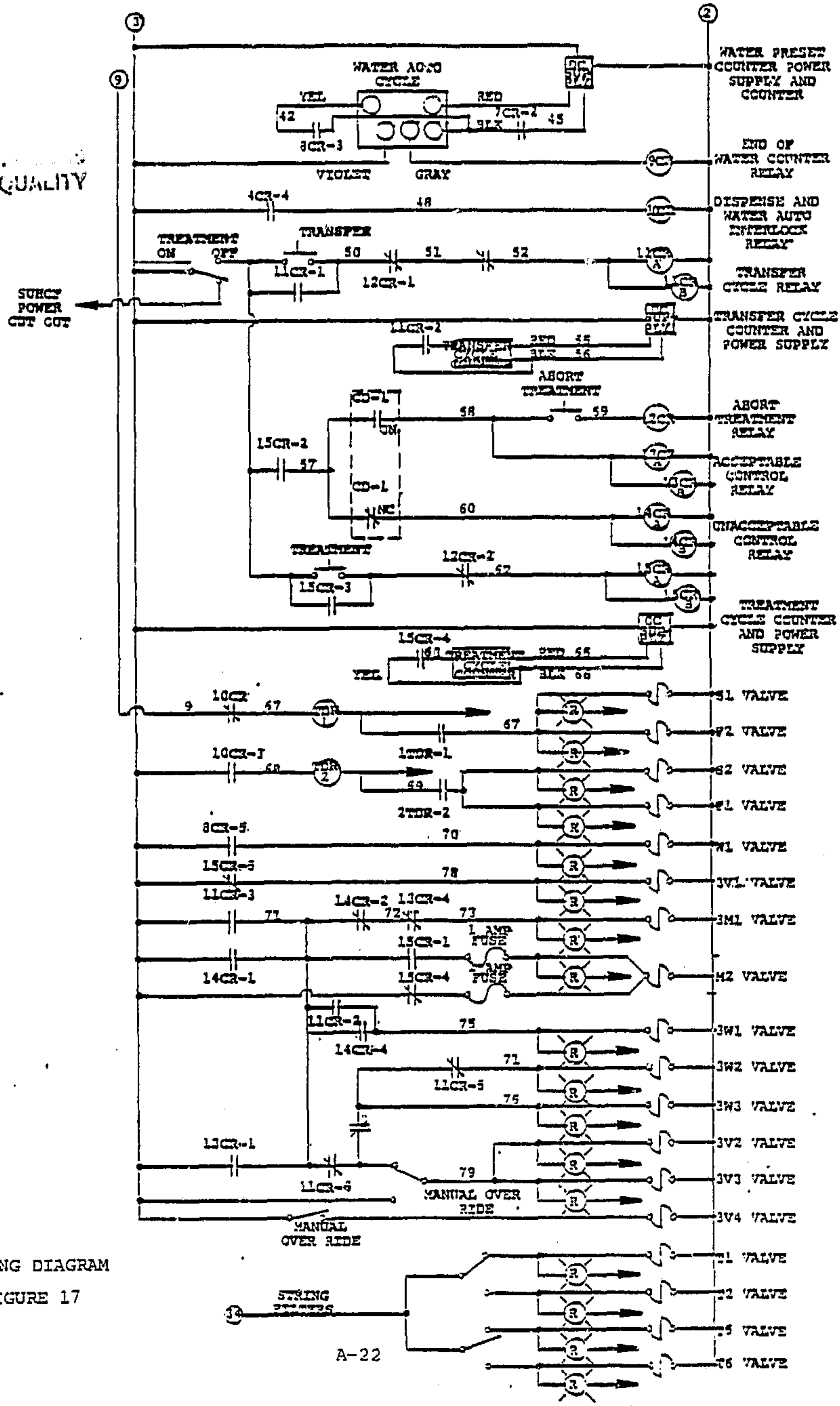
PARTS LIST
FILTER SYSTEM FIGURE 15

LIST 8



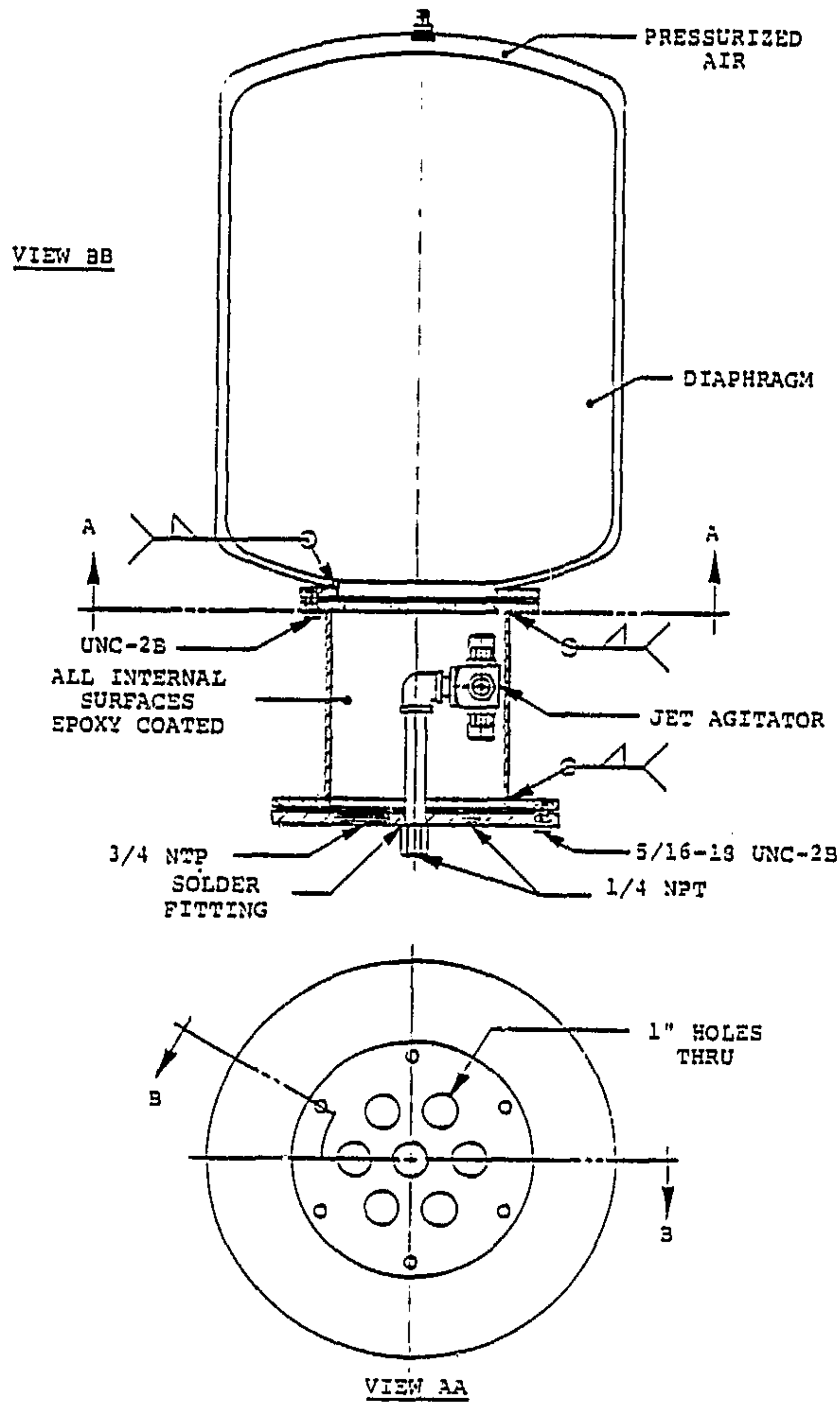
WIRING DIAGRAM FIGURE 16

Reference: NAS-A10-B



WIRING DIAGRAM

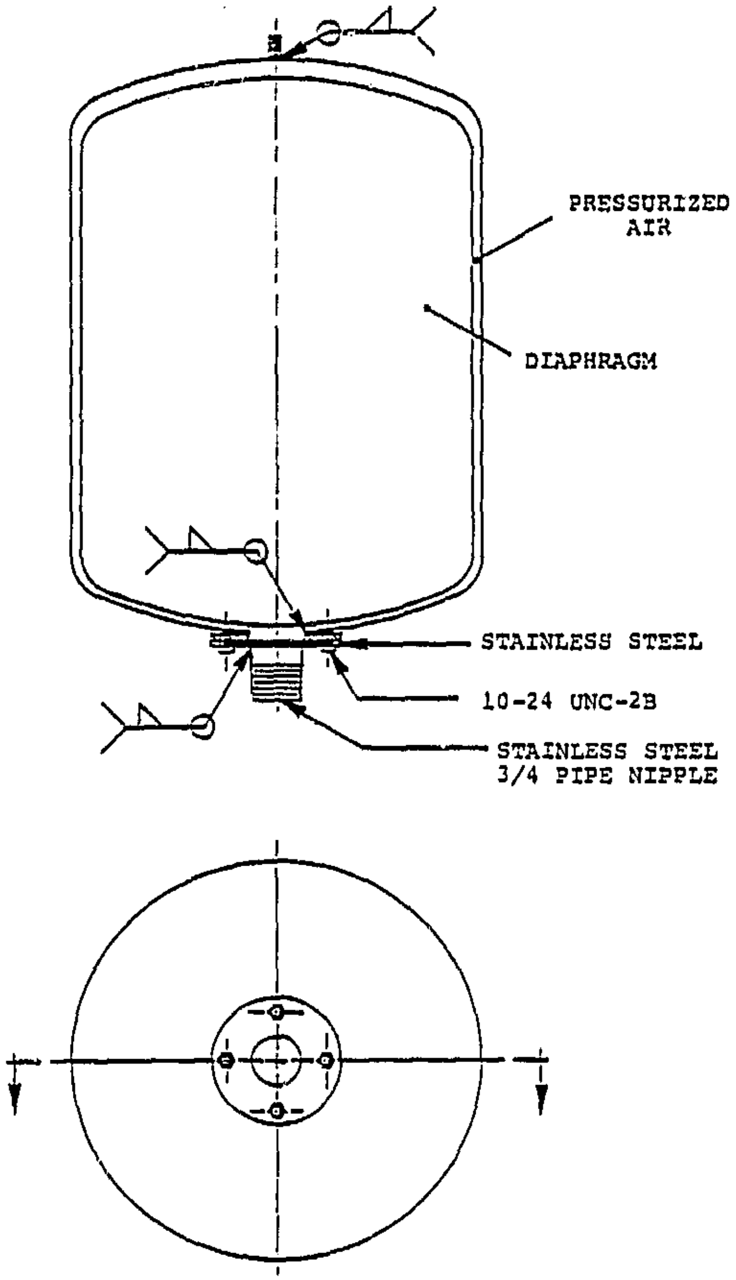
FIGURE 17



OF POOR QUALITY

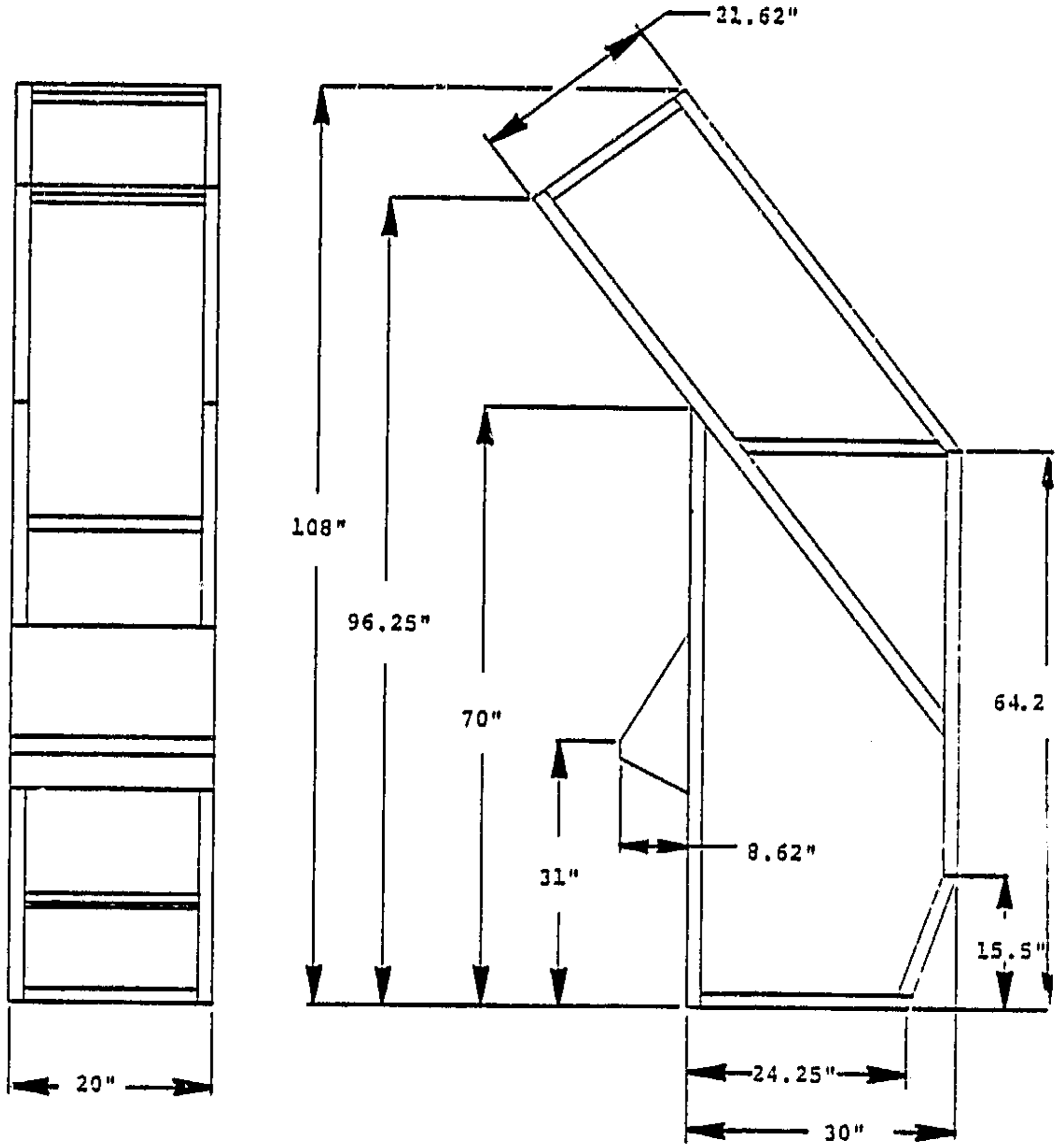
MIXING TANK

FIGURE 18



WASTE TANK

FIGURE 19



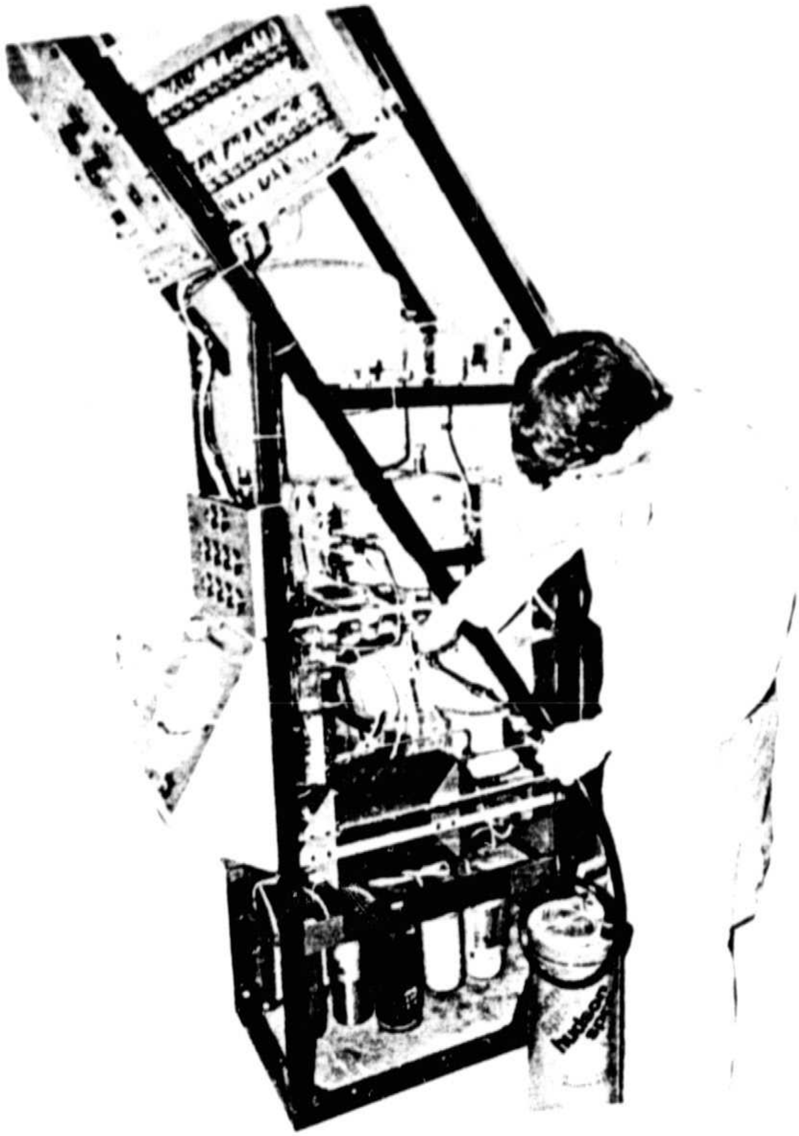
PROTOTYPE PWWWRS/SUHCF
FRAME

FIGURE 20

DEMONSTRATION HAND WASHING
PWWWRS/SUHCF PROTOTYPE

FIGURE 21

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



PWWWRS/SUHCF
RECHARGING SYSTEM

Figure 22

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REAR VIEW
PWWWRS/SUHCF

SAMPLING VALVES AT TOP
MIXING TANK AND DEAREATOR

FIGURE 23

MODEL: CP162 TRIPLE OUTPUT

EDITION NO. 2

INFORMATION CONTAINED:
1. SCHEMATIC
2. PARTS LIST
3. SPECIFICATIONS
4. OUTLINE AND MOUNTING
5. GENERAL USER INFORMATION

power-one INC.
AC POWER SUPPLIES

APPLICATION DATA SHEET

AC CONNECTION TABLE

INPUT 50-60HZ	JUMPER	APPLY AC	FUSE
115 VAC	1 & 3 , 2 & 4	1 & 4	3.0 A
230 VAC	2 & 3	1 & 4	1.5 A

OUTPUT RATING CHART

VOLTS	AMPS STEADY	AMPS SURGE	OVP
+5.0	3.0	———	6.2 ± .4 VDC
−5.0	0.6	———	6.2 ± .4 VDC
+24.0	5.0	6.0	———

WARRANTY

POWER-ONE WARRANTS EACH POWER SUPPLY OF ITS MANUFACTURE THAT DOES NOT PERFORM TO PUBLISHED SPECIFICATIONS, AS A RESULT OF DEFECTIVE MATERIALS OR WORKMANSHIP, FOR A PERIOD OF TWO (2) FULL YEARS FROM THE DATE OF ORIGINAL DELIVERY. RETURNS MUST BE FREIGHT PREPAID.

POWER-ONE ASSUMES NO LIABILITIES FOR CONSEQUENTIAL DAMAGES OF ANY KIND THROUGH THE USE OR MISUSE OF ITS PRODUCTS BY THE PURCHASER OR OTHERS. NO OTHER OBLIGATIONS OR LIABILITIES ARE EXPRESSED OR IMPLIED.

A.C. INPUT: 115/230 VAC ± 10% 47-400 HZ (DERATE OUTPUT CURRENT 10% FOR 50HZ OPERATION)

D.C. OUTPUT: SEE OUTPUT RATING CHART, ADJUSTMENT RANGE, ±5% MINIMUM.

OUTPUT RIPPLE: 2 TO 15V OUTPUTS 5.0 mV PK-PK MAXIMUM. 20 TO 200V OUTPUTS 5.0 mV PK-PK MAXIMUM.

LINE REGULATION: ±.05% FOR A 10% LINE CHANGE.

LOAD REGULATION: ±.05% FOR A 50% LOAD CHANGE.

TRANSIENT RESPONSE: 50μ SECONDS FOR A 50% LOAD CHANGE.

STABILITY: ±.3% FOR 24 HOURS AFTER WARM UP.

TEMPERATURE RATING: 0° TO 50°C FULL RATED, DERATE LINEARLY TO 40% AT 70°C.

TEMP COEFFICIENT: ± .03% / °C MAXIMUM .010% / °C TYPICAL.

VIBRATION: PER MIL-STD-810C, METHOD 514, PROCEDURE X.

SHOCK: PER MIL-STD-810C, METHOD 516, PROCEDURE V.

SHORT CIRCUIT & OVERLOAD PROTECTION: AUTOMATIC CURRENT LIMIT / FOLDBACK.

COOLING: CONVECTION COOLING IS ADEQUATE WHERE NON RESTRICTED AIR FLOW IS AVAILABLE. WHEN OPERATING IN A CONFINED AREA, MOVING AIR OR CONDUCTION COOLING IS RECOMMENDED.

OVERVOLTAGE PROTECTION: SEE OUTPUT RATING CHART.

REMOTE SENSING: LEAD PROTECTION BUILT-IN.

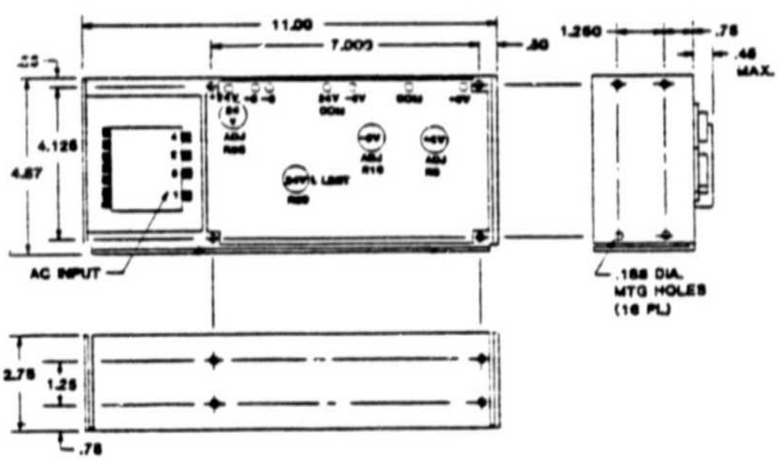
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

IMPORTANT:

THIS POWER SUPPLY FEATURES REMOTE SENSING CAPABILITY. REMOTE SENSING TERMINALS ARE PROVIDED FOR HOOK-UP WHEN USED IN APPLICATIONS UTILIZING THIS FEATURE.

WHEN NOT USING REMOTE SENSING, OR WHEN TESTING THE UNIT TO ITS SPECIFICATIONS, THE REMOTE SENSING TERMINALS SHOULD BE CONNECTED TO THEIR RESPECTIVE OUTPUT TERMINALS AS FOLLOWS:

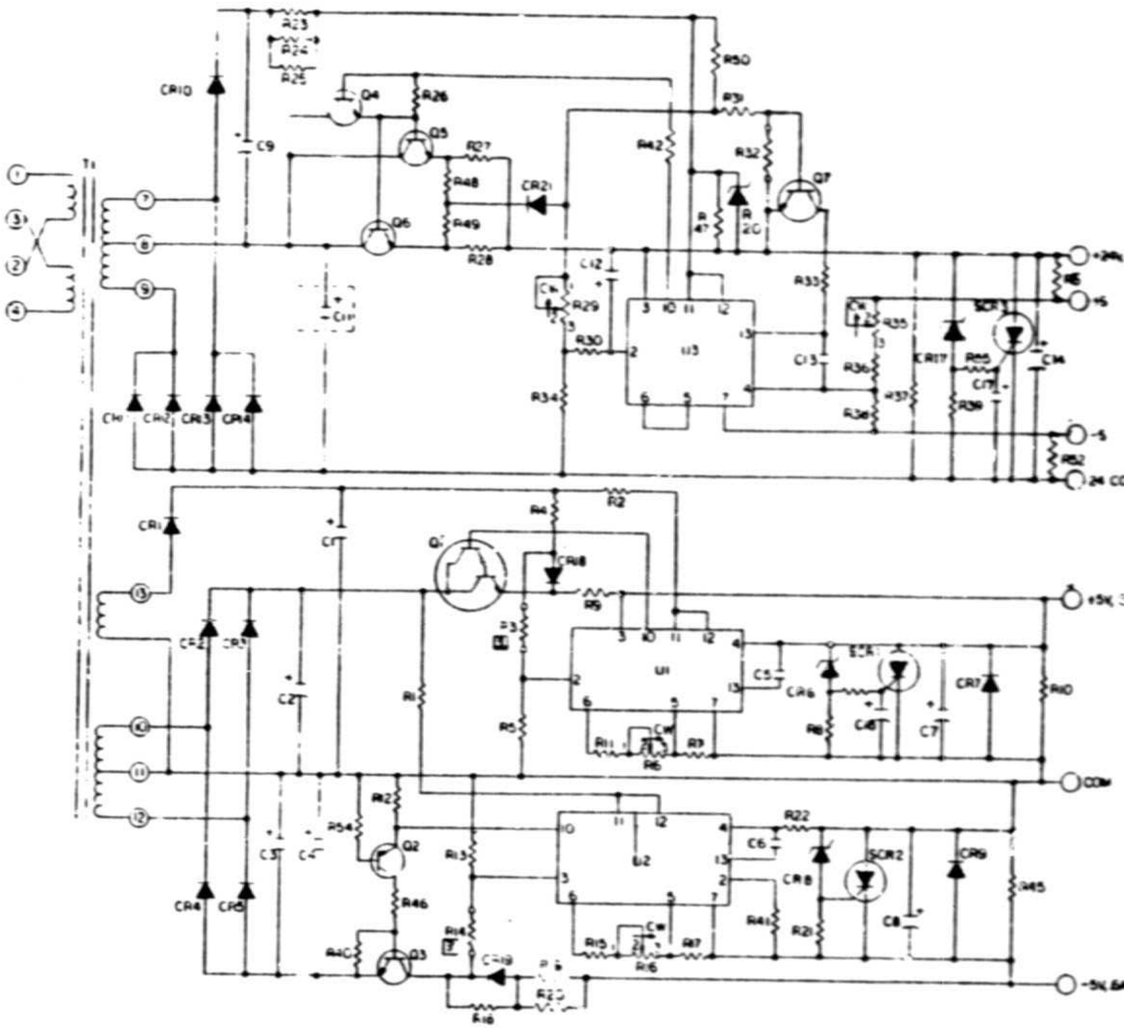
+S TO + OUT
−S TO − OUT



CP162 CHASSIS
UNIT WEIGHT 9 LBS

CP162 CHASSIS

FIGURE 24

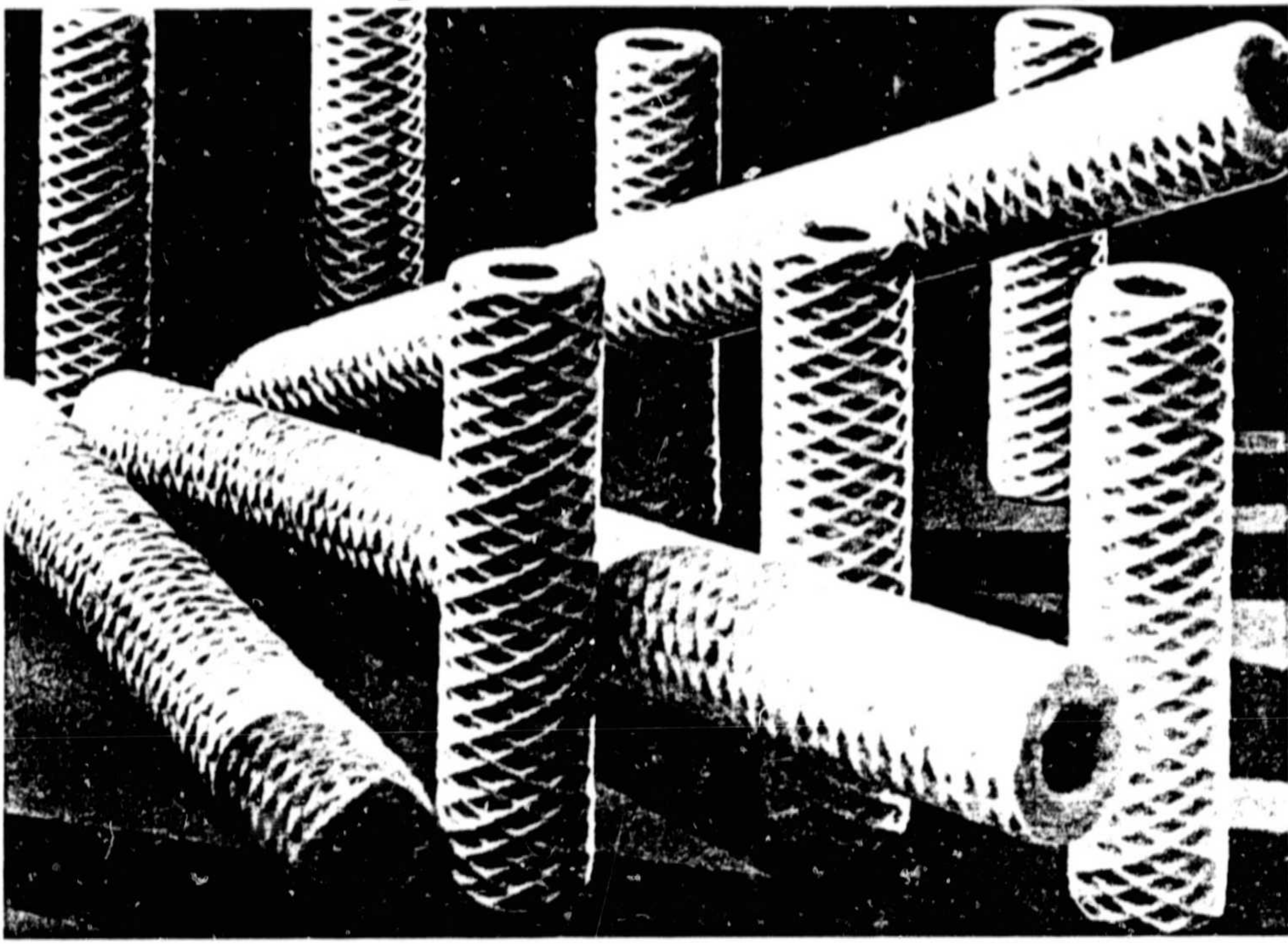


- INSERT R20 IN STUFFING BEFORE SOLDER FLOW.
- SELECT IN TEST TO BE INSTALLED IN FINAL TEST
- ALL VOLTAGES REF TO COMMON OUT PUTS
- VOLTAGE MEASUREMENTS @ 115 VAC INPUT. FULL LOAD ON OUTPUT.

NOTES- UNLESS OTHERWISE SPECIFIED

[illegible]	[illegible]	CAPACITOR, ELECT	[illegible]
[illegible]	1N4003	DIODE	[illegible]
[illegible]	[illegible]	DIODE, 3A	[illegible]
[illegible]	[illegible]	SCR	[illegible]
[illegible]	[illegible]	TRANSISTOR	[illegible]
[illegible]	[illegible]	RESISTOR, 2W, WW	[illegible]
[illegible]	[illegible]	RESISTOR	[illegible]
[illegible]	2K	POTENTIOMETER	[illegible]
[illegible]	[illegible]	I.C. VOLTAGE REGULATOR	[illegible]
[illegible]	[illegible]	PRINTED CIRCUIT BOARD	[illegible]

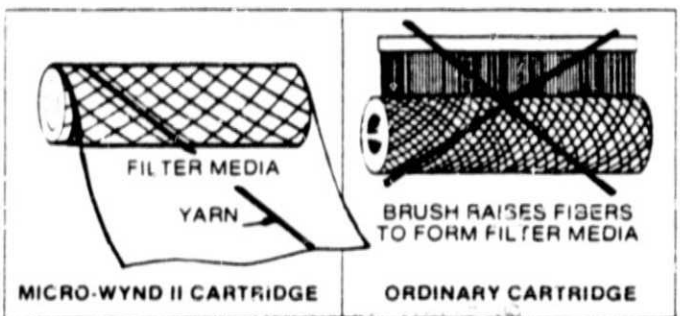
Micro-Wynd II® Filter Cartridges



EFFICIENT MICRON RATINGS

Micro-Wynd II filter cartridge micron ratings are accomplished by constantly maintaining the same matrix winding pitch while varying the quantity and physical characteristics of the filter media material being inserted. Filter media is specially processed by AMF Cuno to strict fiber length requirements. As a result, media fibers bridge at least three diamond openings near the outer surface . . . as the diameter decreases the media fibers are anchored in place by three or more diamond windings. The combination of quantity and positive anchoring of filter media is your assurance of accurate ratings in all density cartridges. With ordinary cartridges the micron rating is changed by varying the winding pitch to open the cartridge as the density ratings become coarser . . . thereby presenting difficulties in securing short "teaseled" filter fibers adequately in place.

CONSTRUCTION WITH A DIFFERENCE



Micro-Wynd II filter cartridges are produced with AMF Cuno's exclusive patented process of combining two *separate* materials simultaneously on a common core. The filter media is applied in blanket form while the matrix yarn or twine is wound spirally under predetermined tension to bind the media blanket securely in position. This winding pattern creates large, diamond shaped chambers to dramatically improve flow performance. At the same time the separately inserted filter media blanket encloses these flow chambers to provide a positive barrier against the passage of micronic size particles. With ordinary cartridges a single strand of yarn is "teased" during the winding operation to produce a filtering media . . . successive windings are relied upon to hold these random brushed up fibers in place.

OPERATING DATA

Micro-Wynd II filter cartridges are suitable for temperature ratings up to 250°F depending upon materials selected. (Refer to individual cartridges for actual rating.) Where a high initial pressure drop can be tolerated, flow rate will be increased, however, this practice tends to reduce cartridge life. While the cartridges are capable of withstanding a differential pressure of 80 psi, it is recommended that for maximum operating economy they be replaced at 25 to 35 psi.

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SPECIAL CONFIGURATIONS AVAILABLE

MICRO-WYND II FILTER CARTRIDGES

SPECIFICATIONS/LENGTHS

METAL SPACER

316 S.S. – Part #37110-32

COMMERCIAL-FILTERITE REPLACEMENTS – (9⅞"-20" and 30" nominal lengths) – for single length cartridges, the AMF Cuno 9⅞" length cartridge can be used. If single length Micro-Wynd II filter cartridges are stacked in these competitive housings, it is advisable to use metal spacers between cartridges to compensate for the ⅛" difference in cartridge length. The spacer also acts as a sealing device to prevent bypass . . . available in 316 stainless steel. Order separately.

EXTENDED CORE ADAPTOR

316 S.S. – Part #63406-32

EXTENDED CORE CARTRIDGES – for replacement of these cartridges, AMF Cuno can supply Micro-Wynd II cartridges with extended core adaptors. Or adaptors, as illustrated can be supplied separately. The adaptors quickly insert into the end of Micro-Wynd II filter cartridges and are removable and can be reused. Order cartridges with extended cores, or, order regular cartridges with separate adaptors.

CARTRIDGE SELECTION

1. POLYPROPYLENE MEDIA – POLYPROPYLENE MATRIX . . . Cartridge for applications involving strong acid, concentrated alkalis, strong oxidizing and reducing agents and other chemicals in aqueous solutions which would react with cotton or viscose. Not suitable for hydrocarbon type solvents such as hexane, naptha, petroleum ether, etc. Generally rated for 175°F with metal cores.

Micron Rating	Tinned Steel Core	304 Stainless Steel Core	316 Stainless Steel Core	Polypropylene Core – 140°F
1	D-PPFY	D-PPSY	D-PPTY	D-PPPY
3	D-PPFA	D-PPSA	D-PPTA	D-PPPA
5	D-PPFB	D-PPSB	D-PPTB	D-PPPB
10	D-PPFC	D-PPSC	D-PPTC	D-PPPC
25	D-PPFF	D-PPSF	D-PPTF	D-PPPF
50	D-PPFL	D-PPSL	D-PPTL	D-PPPL
75	D-PPFQ	D-PPSQ	D-PPTQ	D-PPPQ
100	D-PPFV	D-PPSV	D-PPTV	D-PPPV
350	D-PPFW	D-PPSW	D-PPTW	D-PPPW

2. COTTON MEDIA – COTTON MATRIX . . . Application similar to No. 1 except slightly better chemical resistance to acids and alkalis. Ideal for water, alcohol and other polar type liquids. Cotton is bleached and washed with FDA approved materials to remove all wax and lubricants to permit acceptability on potable water, beverages and food products. Rated for 250°F on liquids . . . 210°F on gases (dry).

1	D-CCFY	D-CCSY	D-CCTY	D-CCPY
3	D-CCFA	D-CCSA	D-CCTA	D-CCPA
5	D-CCFB	D-CCSB	D-CCTB	D-CCPB
10	D-CCFC	D-CCSC	D-CCTC	D-CCPC
25	D-CCFF	D-CCSF	D-CCTF	D-CCPF
50	D-CCFL	D-CCSL	D-CCTL	D-CCPL
75	D-CCFQ	D-CCSQ	D-CCTQ	D-CCPQ
100	D-CCFV	D-CCSV	D-CCTV	D-CCPV
350	D-CCFW	D-CCSW	D-CCTW	D-CCPW

MULTIPLE LENGTH CARTRIDGES

To indicate multiple length cartridges add the following appropriate suffix to the cartridge letter designation.

- **-2** (double length cartridge – 19 11/16")
- **-2x** (double length cartridge – 20")*
- **-3** (triple length cartridge – 29 7/16")
- **-3x** (triple length cartridge – 30")*

*Use these suffix numbers for Commercial, Filterite or other compressive wound cartridge replacements.

Thus D-CCFY-3 identifies an all cotton Micro-Wynd II filter cartridge with tinned steel core, 1 micron rating and triple length construction (29 7/16").

For voile covered core insert the letter "V" prior to the last letter in the code. Thus in the example given the designation would be D-CCFVY-3.

For extended core cartridges, drop the prefix letter D in the letter code designation and substitute with an S as follows:

D-XXXX Micro-Wynd II (no extended core)

S-XXXX Micro-Wynd II (316 stainless extended core)

Note: All extended cores will be 316 stainless steel regardless of cartridge core material.

NOTES:

A. Polypropylene core limited to 140°F operating temperature.

B. Polypropylene core necessary for high acid conditions.

C. Stainless steel core suitable for moderate or low acid conditions.

D. Tinned steel core suitable for neutral aqueous solutions and many organic (non-aqueous) chemicals.

E. The effects of temperature, concentration, aeration and other factors may cause a definite change in the compatibility of the fiber media involved. Whenever the slightest doubt exists about temperature compatibility, simple testing can confirm fiber selection.

Activated Carbon Cartridge

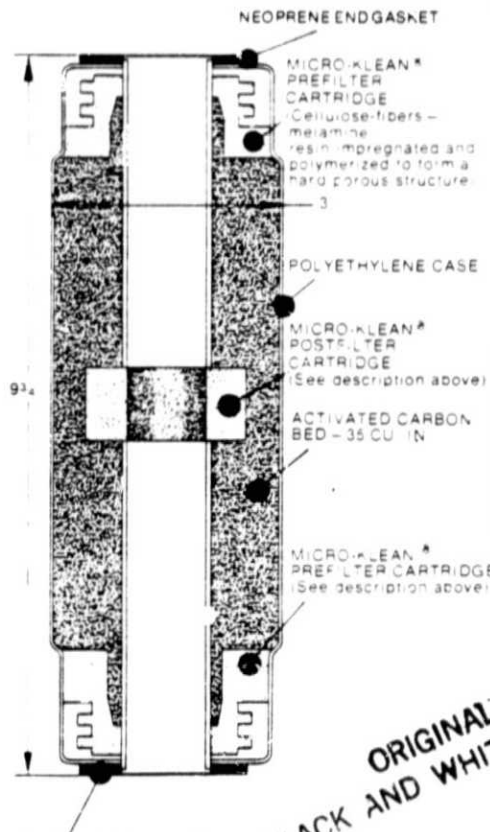
- **HEAT SEALED "NO MESS" CARBON CARTRIDGE**
- **BUILT-IN 5 MICRON PREFILTERS AND POSTFILTER**
- **INTERCHANGEABLE IN MANY EXISTING FILTER HOUSINGS**

AMF Cuno Activated Carbon Cartridges remove chlorine, color, odors and turbidity from aqueous and organic liquids. Since all materials are non-toxic and of food grade quality, the cartridges are also useable on drinking water and potable liquids. The easy-to-change throwaway cartridge contains about 35 cu. in. of premium quality hard granular activated carbon. Millions of active surfaces adsorb dissolved gases and organics, and removes chlorine while prefilters provide 5 micron filtration.

CARTRIDGE CONSTRUCTION

Activated carbon, prefilters and postfilter are all contained in a heat sealed polyethylene case. This unitized cartridge construction eliminates the mess associated with handling carbon. The 5 micron Micro-Klean prefilter cartridges remove dirt, rust and other sediment in the liquid. The 5 micron Micro Klean postfilter prevents the activated carbon from escaping.

AMF Cuno Activated Carbon Cartridges can be used in either single cartridge filter housings or stacked in multiple cartridge housings (end gaskets provide the necessary seal in either arrangement).



CARTRIDGE OPERATING DATA

The AMF Cuno Activated Carbon Cartridge is capable of supplying 3 gpm of water at 6 psi differential pressure. Since prolonged contact time can increase the adsorption efficiency, it may be desirable to maintain a flow rate to 1 or 2 gpm per cartridge or less on some applications. When the carbon is spent, the taste, odor, etc., will return in the effluent and indicate a required change of cartridges. Should liquid pressure fall off, then the prefilter cartridges are being prematurely clogged with excess sediment and a larger Micro-Klean II filter cartridge unit should be installed ahead of the carbon cartridge filter.

Cartridge life will vary in proportion to the amount of dissolved gases, etc., in the liquid. Other factors influencing cartridge life will be flow rate, water temperature, ph level, and whether operating on continuous or intermittent service.

Cartridge Catalog No. 46285-01
Temperature Limit 100°F

LIQUID FERRIC CHLORIDE

Properties

Pennwalt liquid ferric chloride is a dark brown solution of $FeCl_3$ in water. The concentration of the solution shipped at a given time is determined by two factors. First, of course, the $FeCl_3$ content of the solution should be as high as possible, to keep the transportation cost per unit of $FeCl_3$ as low as possible. Second, crystallization of the ferric chloride due to low temperatures during transit or storage is troublesome, and concentrations are limited by the ambient temperatures prevailing at the time. For this reason, the shipping strength of Pennwalt liquid ferric chloride solutions is varied from 45% in summer to 38% in winter.

Shipping Containers

Pennwalt liquid ferric chloride is shipped in rubber-lined tank cars and tank trucks, in the quantities shown in Table 2.

TABLE 1—PROPERTIES OF LIQUID FERRIC CHLORIDE

Ferric Chloride Content*		38% to 45%	
Molecular Weight		162.22	
Form and Color		Dark brown liquid	
Specific Gravity		1.4 to 1.5	
Average Crystallization Temperature:	39%	7°F	−13.9°C
	40	14	−10
	41	21	−6.1
	42	28	−2.2
	43	35	1.7
	44	42	5.6
	45	48	8.9
	46	55	12.8

*Concentration is adjusted seasonally to avoid crystallization during transit. During periods of sustained, severely cold weather, concentration may be lowered to 38%.

TABLE 2—PENNWALT LIQUID FERRIC CHLORIDE SHIPMENTS

Shipping Container	Volume	Approx. Shipping Weight
Tank Cars, Rubber Lined	4,000 gal.	23 tons
	6,000 gal.	34 tons
	8,000 gal.	46 tons
	10,000 gal.	57 tons
	18,000 gal.	100 tons
Tank Trucks, Rubber Lined	Quantity dependent upon applicable state truck weight regulations.	

SAFETY AND FIRST AID

Safety. Great care should be taken to avoid the contact of anhydrous ferric chloride with any part of the body, and especially with the eyes. The moisture present in the eyes or on the skin is enough to release sufficient heat to cause severe damage. Ferric chloride solutions should be handled with the same care as acid solutions, since they can cause burns similar to those caused by acids. They are also injurious to clothing and cause difficult-to-remove stains. Personnel handling anhydrous ferric chloride or ferric chloride solutions should wear overalls, rubber apron, rubber gloves and chemical goggles. Floors, walls and equipment which are subject to splashing should be protected with corrosion-resistant paint or rubber mats.

First Aid. If *anhydrous ferric chloride* comes in contact with the skin or clothing, *do not* wash immediately with water. Severe burns can result from the great amounts of heat produced when anhydrous ferric chloride is dissolved. Wipe off the excess ferric chloride first with a cloth, and then wash with large amounts of water.

If *liquid ferric chloride* comes in contact with the skin or clothing, wash it off immediately and thoroughly with water.

In cases of splashes of liquid ferric chloride in the eyes, flush immediately and thoroughly with large amounts of water for at least 15 minutes and then rinse with a weak solution of sodium bicarbonate or boric acid. Consult a physician immediately.